WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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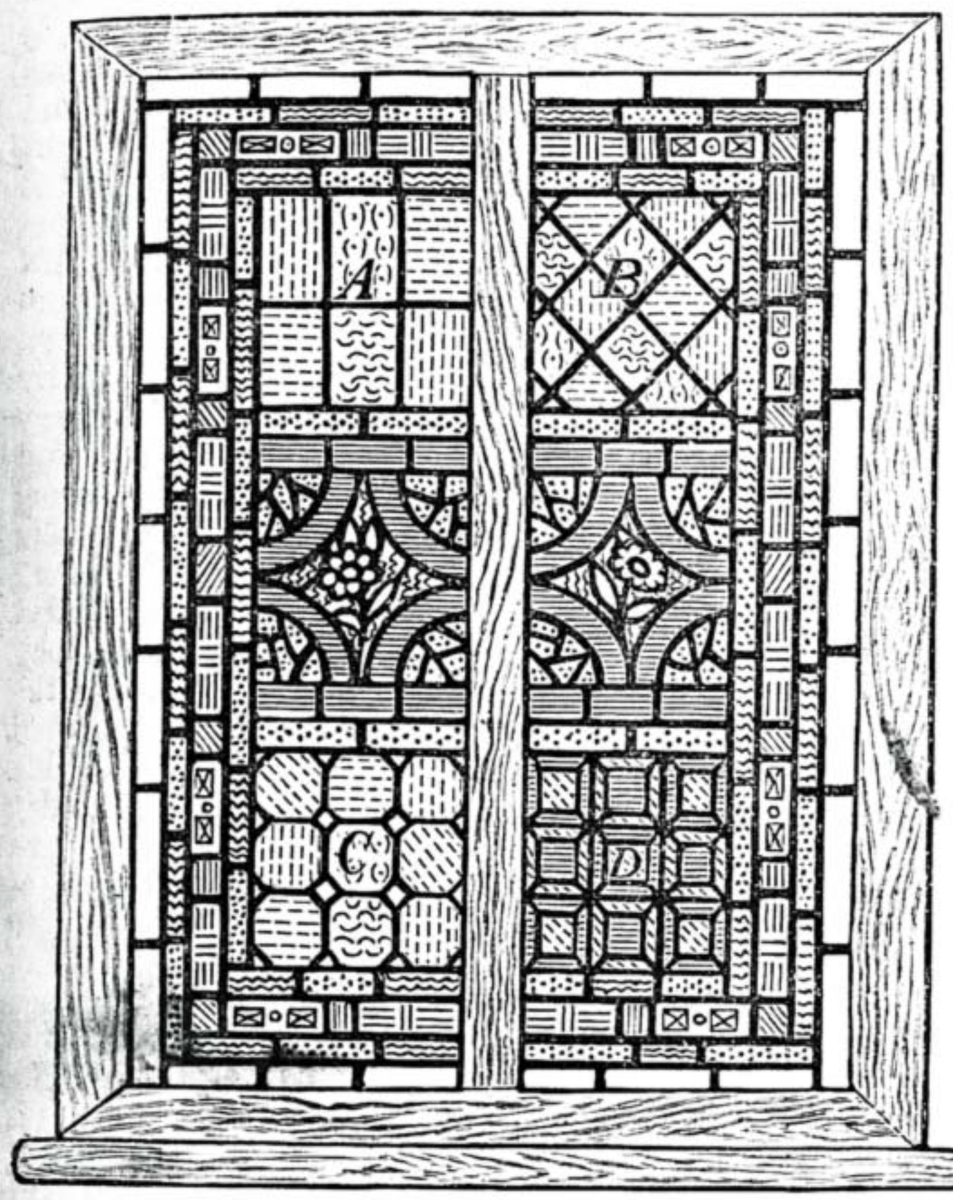
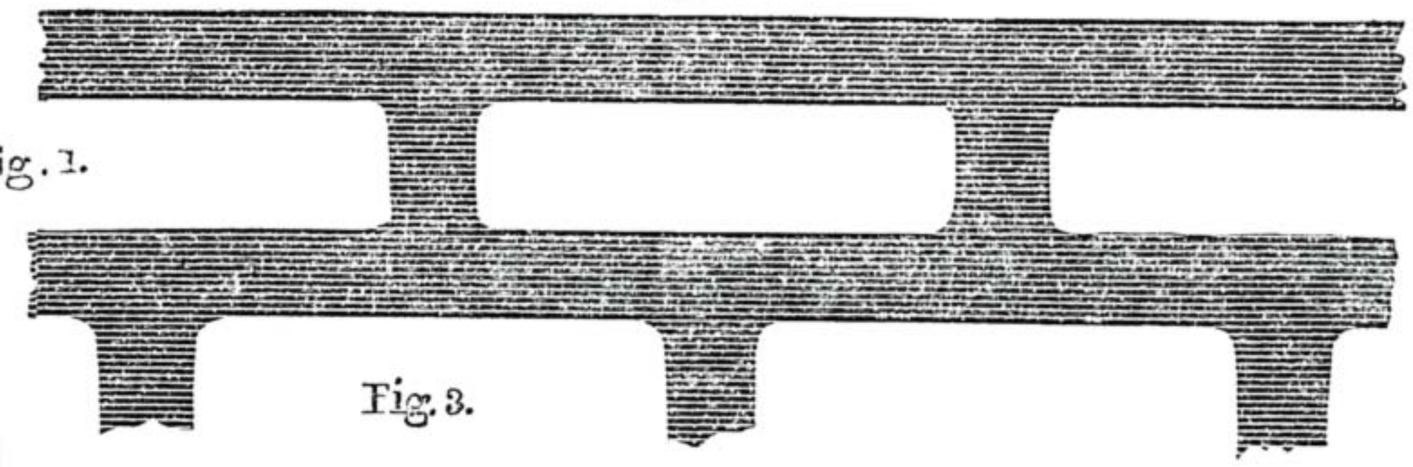


Fig. 2.

Fig. 1.



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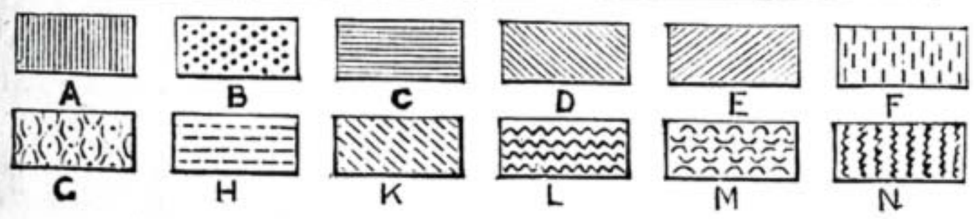

Fig. 1A.

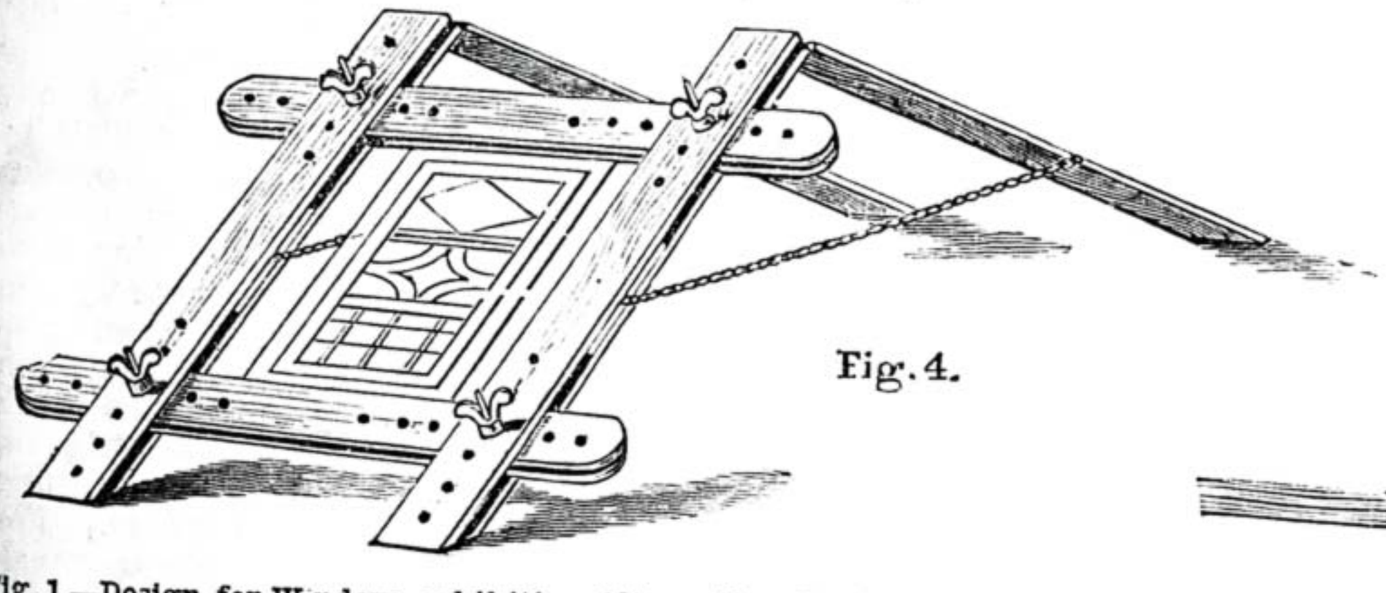

Fig. 4.

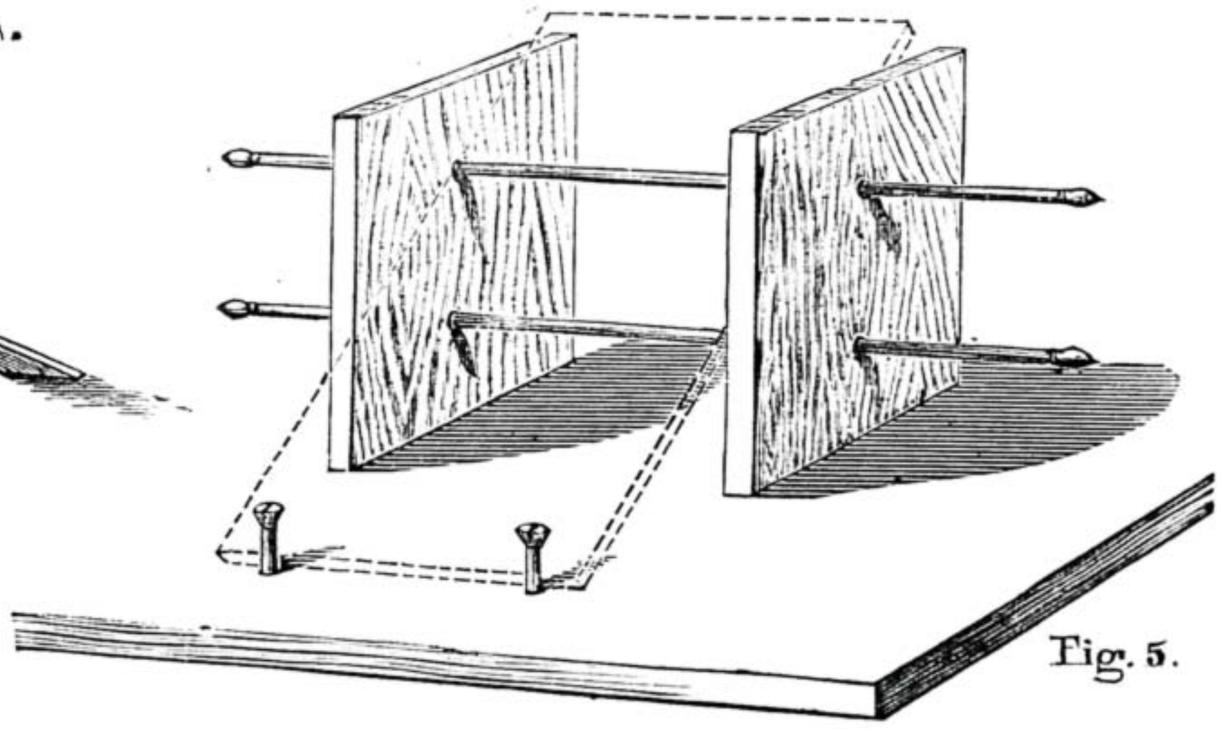

Fig. 5.

Fig. 1.—Design for Window, exhibiting Alternative Patterns. Fig. 1 A.—Explanation of Colours to be used according to Markings in Figs. 1 and 5—A, Scarlet; B, Yellow; C, Peacock Blue; D, Green; E, Purple; F, Pale Pink; G, Pale Yellow; H, Pale Blue; K, Pale Green; L, Light Brown; M, Pale Brown Tint. Fig. 2.—Design for Over-Light. Fig. 3.—Mode of Painting Broad Lines of Division between Colours. Fig. 4.—Easel. Fig. 5.—Substitute for Easel.

SILICINE GLASS PAINTING.

HOW TO PAINT A WINDOW IN IMITATION OF STAINED GLASS.

BY F. B.

MANY of the readers of WORK are, no doubt, acquainted with one or several of the various kinds of transparent coloured paper sheets which are now being sold for the purpose of being affixed to windows in imitation of stained glass. Some of these are highly artistic, and, if applied with taste, form a pretty decoration for windows. They are affixed without much trouble, and fairly permanent, provided proper care is used in laying them on. They are inexpensive, and answer their purpose admirably in all those cases where nothing is aimed at beyond shutting out an unpleasant view or effecting a temporary or unpretending decoration quickly, without any great expense, and without any great exertion. They will, however, scarcely satisfy those who wish to be original and to give play to their own artistic tastes and personal skill. It is to this class of readers that I will endeavour to describe briefly a method of decoration for windows, screens, etc., which was introduced some time ago as "Silicine Glass Painting," being, as the name implies, a process of actual painting. The effect is, as near as any imitation can be, that of real stained glass, but while, in the latter, the colouring matter is permanently fused with the glass by firing or baking in specially constructed kilns, in Silicine Glass Painting

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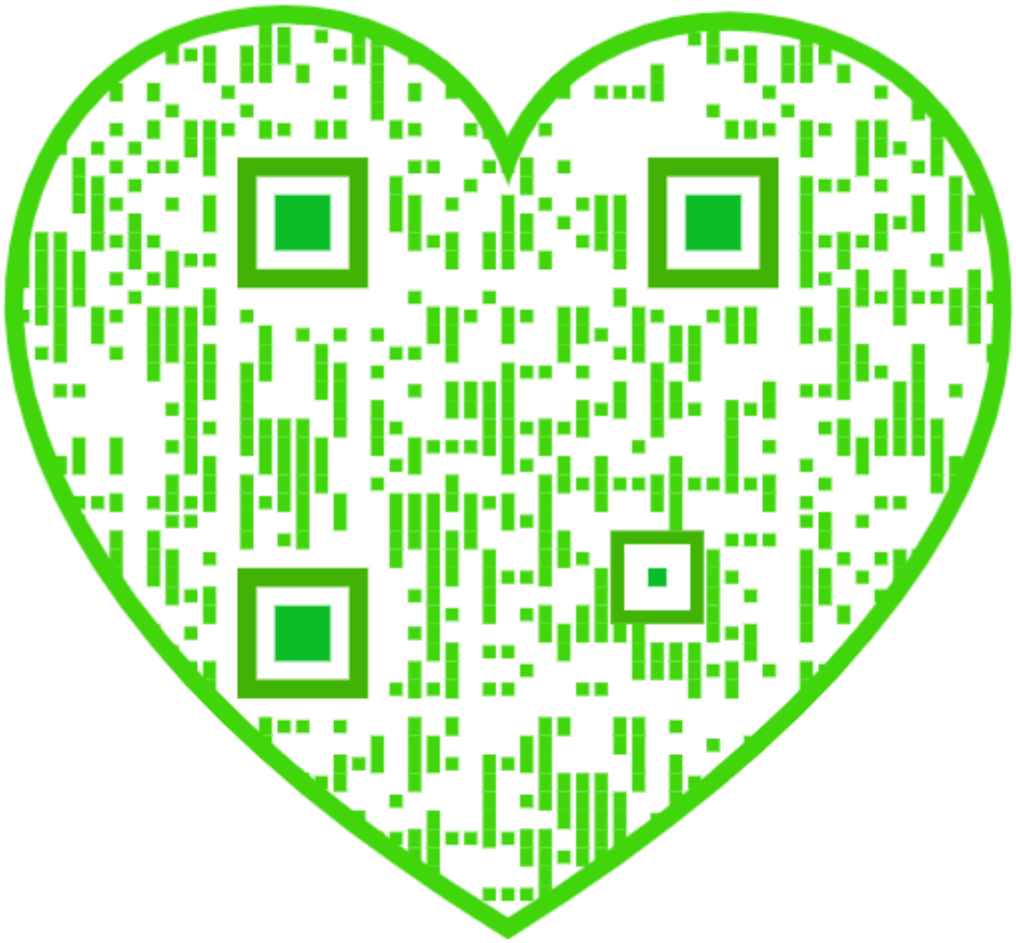

specially prepared paints are applied in the same manner as oil paints would be to canvas or water-colours to paper, but with the admixture of a certain vehicle, called "Silicine," which not only renders the colours perfectly transparent, thereby greatly adding to their brilliancy, but also firmly unites them with the surface of the glass.

This, in a few words, is the principle of the process. The *modus operandi* is simple enough :—

If you wish to paint a window, you will, first of all, have to choose your design. Much, of course, will depend on the situation of the window, its size, and also the degree of your aspirations.

You would, naturally, choose a very different design for a drawing-room window from that which you might think suitable for the hall or staircase. For large panes of a staircase window, a bold and heavy design would be more effective; while, in a dwarf blind of a sitting-room window, more detail might be introduced to advantage.

In the former general effect is wanted; in the latter repeated and closer inspection of the work may be anticipated. For a first trial I should recommend a simple geometrical design, to those especially who have not had a very extensive practice in the handling of the brush.

In accordance with the design, we must now decide on the kind of glass to be employed, for I may here mention that it is best to use separate sheets of glass, that can afterwards be fixed into the sash, in addition to the pane that is already there, and without disturbing the latter.

I have painted windows on the original glass in the sash, but sadly regretted having done so in each case.

Any kind of glass can be used, but I prefer to use the rough kind with a wavy surface, known as "Cathedral" glass, and I should certainly recommend the use of it, except in the case of designs with elaborate details. Cathedral glass is most effective, owing to its uneven surface, which breaks the rays of the light, whereby a remarkable amount of life is imparted to the colours, and, as it does not permit of objects behind being seen through it, the outline of the design is not disturbed by any foreign object shining through. In cases where the latter quality may be objected to—for instance, when the view into the street or garden is desired to be preserved by only partially painting the window—of course, ordinary window glass has to be used. For landscapes, flowers, or figures, painted minutely, ground glass is to be recommended. This material produces pleasing effects of great softness.

Let us assume we have chosen a geometrical design—say, something similar in character to Fig. 1—and decided on cathedral glass as the material. First of all, it is necessary to have the glass for each pane cut to the exact size, so as to fit readily into the sash. This is important, as it is difficult to cut the glass when painted without injuring the work. In cases where the existing panes are not puttied in, but held in place by means of beadings, the measurements should be taken after the beading has been removed, as the same beading will serve for fixing in the painted glass as well.

If there are more panes than one, they should be properly marked and numbered, as even panes of apparently the same size often vary just sufficiently to make an exchange disappointing. Now, having ascertained that the dimensions of our material are quite correct, we will proceed to trace the design on the glass. It is a good plan to draw the design on paper first, and to colour it in water-colours, in order to get an idea of the general effect. When the drawing on paper is ready place your glass on top of it (as indicated in the sketch of the easel used for this kind of work in Fig. 4), with the side to be painted on (that is, the side which will face the glass already in your window) downwards. Secure the paper to the glass by means of strips of gummed paper, or a drop of gum at the corners, to prevent the copy from shifting during the process of tracing. The latter is done with Indian ink and an ordinary drawing pen. If the glass has first received a coating of silicine medium very much reduced with spirits of turpentine, and the same has got quite dry, the ink will not run, as it is liable to do on glass not so prepared, especially when it has not been thoroughly cleaned. It will be noticed that the parts in Fig. 1 marked A, B, C, D, are all different. Of course it is not intended that they should be so painted, the idea being to show four different styles of easy groundwork in the same drawing. Any one of these four styles can be used throughout, or two of them in pairs; for instance, style A for the top of each pane, and style C for the bottom; or one each in reversed order, forming this figure—

A C.
C A.

When the outline is completed remove the copy, and the glass is now ready for painting.

The following colours and materials are required. They can be obtained through any respectable artists' colourman.

Colours for silicine glass painting—yellow (6d.), red (1s.), rose (6d.), blue (6d.), light brown (6d.), dark brown (6d.), black (6d.). Of rose, yellow, and black, it will be as well to get two tubes at once.

1 bottle of silicine medium (1s. 6d.).

1 bottle of silicine gloss (1s. 6d.).

1 flat camel-hair brush, in tin, 1 inch wide.

1 camel-hair mop, No. 6 or 7 size.

2 or 3 fitch hair brushes for oil colours, flat sizes, 4, 6, 10. These should be made of short hair, or what artists call "brights."

1 or 2 round fitch hair brushes (sizes 2 and 4).

2 ox-hair riggers, say, sizes 6 and 12.

1 china palette, 1 palette knife, 1 brush washer filled with turpentine.

Besides the above an easel of a peculiar construction and specially made for this kind of work, shown in Fig. 4, may be found useful, but can be dispensed with if economy is to be studied. The foregoing is all that is required for simple designs such as represented in Fig. 1. For more elaborate and minute work, a few fine red sable brushes, and a steel scraper for taking out high lights and softening shades, would have to be added to the list, while for very large work a few large flat camel-hair or fitch hair brushes in tin would be required.

Now let us return to our work; we have left it ready for painting. We shall require good light, and should have a small table placed near a window, seating ourselves facing the same. The light must not, however, be too glaring, or it will have a bad effect on the eyes. If you have bought an easel, we will fix the glass into it, the side with the Indian ink outline downwards, and place it on the table, which should be covered with white paper or a white cloth, in such a way as to bring the glass into a desk-like slanting position. If you have no easel, a very simple rest is easily constructed by passing two stair-rods through two pieces of deal board, as shown in Fig. 5; the whole standing on the lid of a packing case, an old drawing board, or such like, two nails in front of the edge of the glass preventing it from slipping. An ordinary rest for fire-irons will form a ready-made rest for your glass, if you do not care for the stair-rod and deal board contrivance.

These preparations being completed, ascertain that the glass is scrupulously clean; if not, there is still time to give it another wipe without interfering with the outline, the latter being on the other side of the glass. Now prepare the first colour you intend to lay on (say the yellow in border of Fig. 1) by squeezing a small quantity on the palette, pour on a few drops of silicine medium, and well mix with a palette knife. This point is very important, as on it depends the general effect of your work. If the medium is used too sparingly or insufficiently united with the colours, the latter when dry present a dull and semi-opaque appearance, instead of being brilliant and perfectly transparent, as they will be when properly applied. Lay on the colour evenly and thinly with a flat fitch hair brush, taking care to completely fill the outline, especially the corners. Any little gaps left blank look very ugly, and quite spoil the effect when the work is finished. You may perhaps find at first, that by laying the colour on thinly you do not get the desired depth. If so, do not be tempted into loading the colour on, but allow the work to dry and then apply a second and even a third coat, until you get the desired depth of colour. This remark applies especially to rose and red, and as the manipulation of these two colours requires a little patience and practice, I have avoided large surfaces of deep scarlet in marking out the colours for Fig. 1. Where scarlet does appear it is produced by alternate layers of red and rose, until the desired depth is reached. The other full strength or flat colours are laid on in the same way as described above, and will offer no difficulty. Peacock blue is mixed with blue and a little yellow, purple is obtained by mixing about 10 parts of rose with 1 part of blue. I may here mention that blue is remarkably powerful, and whenever you have occasion to mix it with any other colour, you should add it little by little, or you may have to waste too much of the weaker colour in trying to counterbalance the excess of blue. Having filled in all the flat colours, we proceed to wash in the tints in the parts A, B, C, D, and also the groundwork in the centre, unless you prefer to let the flower appear on a blank ground. For producing the light shades, reduce the strength of the corresponding colours by adding more medium. For laying on these rather liquid shades a camel-hair mop is preferable. Apply as evenly and thinly as you can, and allow to dry a little, but not completely; then with the tip of your finger go over the painted surface, which should feel just a little sticky (tacky), dabbing it gently all over until every unevenness has disappeared. I need not say that this operation must be confined to one colour at the time, and that the tip of the finger must be well wiped before a fresh tint is begun.

The ground of the oblong spaces between the yellow and brown border is left blank, the thread line pattern being painted in dark brown with a fine fitch hair brush. Dark brown should be mixed with rather more

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medium than the other colours. At this stage the work should be left alone until it is absolutely dry. This will probably be the case in twenty-four hours, but under certain circumstances it may take two or three days. When quite dry, paint in all the lines or bars imitating leading with black, using an ox-hair rigger, but laying the colour on thick and solid, so as to be perfectly opaque when held up against the light. Special attention should be paid to this point, for it will be readily understood that leading partially transparent would be a poor imitation of the real article. The black lines may be broad and bold, and so far from disturbing the design they will add to the effect. This will soon be apparent if one half of a pane is quite finished off and compared with the other half without leading. The joints of lines should be painted without sharp angles, as shown in Fig. 3.

I may here mention that, in cases where one design is spread over a window with several panes, sash bars may be completely ignored. They will not to any extent interfere with the general effect. When the leading is absolutely dry and hard, give the whole a thin coating of silicine gloss, using a flat camel-hair brush or a large mop. The painting is now finished, and when dry is ready for glazing. The Indian ink lines can now be washed off, and the panes fixed into the sash by means of narrow beading. The painted side is of course to face the glass already in the window, so that the painting itself is really between two sheets of glass, but the latter should not touch. To prevent this, a few narrow strips of cardboard should be glued between the edges.

Fig. 2 is a design for an over-light, that could be adapted to almost any front door, giving either the number or the name of the house. In this case the outline of the figure or letters could be painted with flake white, or first with silicine black, and gold bronze enamel over it, so as to be visible also by daylight.

I shall be glad if many will be induced to try their hands at Silicine Glass Painting, and have no doubt that after having mastered the little difficulties that may present themselves at first, all will be pleased with the result of their labour and patience, and feel encouraged to attempt work of a more elaborate character. I shall be happy to answer any inquiries about Silicine Glass Painting in "Shop."

ON CAUSES OF FAILURE IN AMATEURS' AND APPRENTICES' WORK.

BY B. A. BAXTER.

In these days, when amateurs flourish and apprentices diminish in numbers, work good, bad, and indifferent is done in large quantity, and I feel sure, from a wide and long experience, that, in many things, the amateur has the advantage.

Such periodicals as this, and others, especially cater for him; so much so, that the professional worker is often able to obtain hints, helps, and often real instruction from such papers, while there are few exclusively professional papers or books that help the young apprentice who is desirous of obtaining a mastery over his work.

Beginners often—in fact, always—add to their own difficulties by indifferent performance of the previous operations.

This is an argument for carefulness in every department of work, for materials badly cut out are sure to be more trouble to make up, while the worker gains no extra result from his increased labour, and shaping the badly cut stuff may result in reducing it below the required dimensions. It would be well, therefore, if, taking one tool first, the apprentice gained a fair mastery over it before trying to succeed with another. The plane is, perhaps, the best tool for a commencement. Articles on its use have appeared in WORK, and a staff of enthusiastic helpers are always ready to give instructive replies to any definite queries.

In advising the use of the plane as the first tool to be mastered by a beginner, we are not ignoring the fact that the work must be sawn out before it can be planed, but merely suggest the advisability of getting some freedom in the use of one tool rather than endeavouring to master several tools at quite the onset. If, however, the use of the saw is first practised—as, indeed, it often is—let our young friend accept the decision of those who instruct him, and try as quickly as possible to become a good sawyer. He will be appreciated in any shop and by every workman, for a lad who saws well is all too rare.

If my young friends whom I am now addressing will try a simple experiment, they will be able to take a position which will enable them to saw truly, and, as the ability grows, they will be able to saw truly in any position and in any attitude. Let a plumb line be hung before the lamp, and the marked timber be so placed that the shadow of the plumb line coincides with the mark on the wood to be sawn. Now, if the saw is used in such a position that its shadow is a thin line falling along the mark on the timber, all is well, and the wood will be cut correctly. This method has the advantage of constantly giving an indication of the sawyer's accuracy or want of it, but it has the serious disadvantage of requiring artificial light, and supposes one light is in use. For those who work by daylight, the good old plan of trying with a square from time to time must be adopted, the only drawback being that its *sufficient* use is so tedious that it is very difficult to persuade beginners of its necessity.

A few trials made with its very frequent use, coupled with careful observation of the position of the elbow, will soon help the sawyer over the difficulty. He will find the elbow requires to be neither too close to the side of his body nor extended too far away, but must move in a path over the line marked on his timber. I have said nothing about saws and their characteristics, as "J. H." has recently given a full and correct description of these indispensable tools.

If the learner has to mark out as well as saw the wood, another source of difficulty is presented. A beginner never seems able to divide a board into a given number of equal parts. Even if he can saw on his line, he finds, after they are sawn, variations of width so considerable as to demand much reduction by planing before the pieces are reduced to uniformity of dimensions.

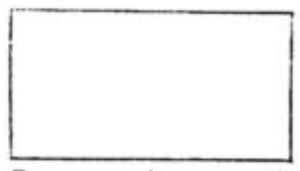
It stands to reason that, if lines, equidistant from the edges and from each other, are drawn on a board, and if the saw divides truly to the lines, that the outer strips will be a trifle wider than any of the inner ones, though the fact is often forgotten or not known. If the saw itself makes a "kerf" $\frac{1}{8}$ in. wide, the outer strips will be $\frac{1}{16}$ in. wider than the inner ones, supposing the marking and sawing both to have been done as accurately as possible. The reason is obvious on consideration. The board, being equally divided by lines, each strip may be expected to lose the thickness of the saw "kerf," except the outer strips, which only lose half that amount.

An easy way to divide a board into several pieces without calculation may not be known to the younger readers of WORK. Take your rule and decide on how many divisions you wish to make. Say the board is over 10 in. wide, and you wish to divide it into seven parts, lay the rule across at such an angle that 14 in. of the rule extend obliquely across the board, then prick off every 2 in., and you have the required division.

Never saw a little way and leave off to begin again at the other end, hoping to do better, for if you went astray before, cutting from the other end will not mend matters, whether the fault is in the workman, the material, or the saw. Even a trifling error in angle becomes a serious one when an opposite error is introduced at the other end of the same cut. The knowledge that an error in sawing is apt to increase, and that the saw-cut, though not the error, is to continue to the end, will help the beginner to endeavour to return to the line as soon as he perceives he has left it.

Some saws have a tendency to go wrong—a sort of obliquity of evil tendency; such saws are either "in-winding" through having been strained, or are badly sharpened or unevenly set. Frequently, however, amateurs cut against a nail which only touches one side of the saw, and takes therefore the set away from that side of the teeth. Have the saw sharpened as soon as possible; let not the amateur believe that saw is trustworthy after such treatment.

Passing over the planing of which we have treated, one other pitfall of beginners' handicraft is the want of system. We have often seen a beginner plane the edges of a piece of wood, having a square to guide him, and get first one angle right and then another which alters the first, or the opposite angle correct, although the sides are not parallel. Now, a beginner will never square a piece of wood in this way, but, by means of a system, he will soon be able to do it well. Let him do it in the following way, whether it is a long piece of square timber or a drawer front, or end of a packing case:



Plane edge A as correctly as possible, and mark the angles B and C square: then, if necessary, gauge the remaining side parallel to the first, but by no means alter A after you have squared either angle.

The beginner ought to remember that, as the angles of a four-sided figure added together amount to four right angles, deficiency in one angle causes redundancy in some other, and that want of parallelism in opposite sides causes variation of angle. Another golden rule is the principle of triangles. Remember that if the sides of a triangle remain unchangeable, the angles are also unchangeable. This, though so easily said, is of the greatest practical importance, and, when the learner is reminded that every four-sided figure may be regarded as two triangles, the importance of the foregoing will be seen to be much increased.

The workman who has any special line always tries to contrive some special tool or appliance that will help him. If the amateur or the beginner tries to do the same, the endeavour will be of the utmost benefit to him, and the result will be seen in increase of resource, in greater speed and facility of execution, and improvement in the quality of his work.

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SMITHS' WORK.

BY J. H.

EARLY HINGES ON CHURCH DOORS—IRON GATES OF MEDIÆVAL AND MODERN TIMES.

THE study of the early hinges of our church doors is a deeply interesting one. They are a poem in iron, coming to us from times when every man did that which was right in his own eyes; times of lawless violence, times of fusion of Saxon and Norman, ages of warrior prelates, and periods of gradual settlement of races, and of growth of the arts of peace. Designed primarily to afford the greatest possible security and strength to the church doors against heathen invaders, they gradually developed, with the advent of more peaceful times, an overflowing wealth of floriated ornament. Originally rough, the work of the hammer and of the punch only, they acquired more and more finish as the file and the drill were brought into requisition.

There are no examples of Early English hinges so barbarously simple as our plain strap hinges formed of a single bar of iron clamping the door. The simplest type is that of a central strap flanked by a semicircle on each side—a crescentic form—and one which flourished during two or three centuries. There was good reason for the adoption of such a form. The church was the common sanctuary in turbulent Saxon and early Norman times; and since its doors were liable to be beaten in by insurgent hordes, the great hinges, stretching right across and covering almost the whole of the faces, sustained and strengthened the wood. Utility at the first, then, was the prime condition studied by the smith, and ornamentation was almost disregarded. The early hinges are therefore massive and rough—some of them very rough—the curves ungraceful, and the hammer marks everywhere apparent. But even then some rude scroll work or foliage was commonly formed at the termination of the straps. And this afterwards became developed into the highly ornate forms seen in the classic

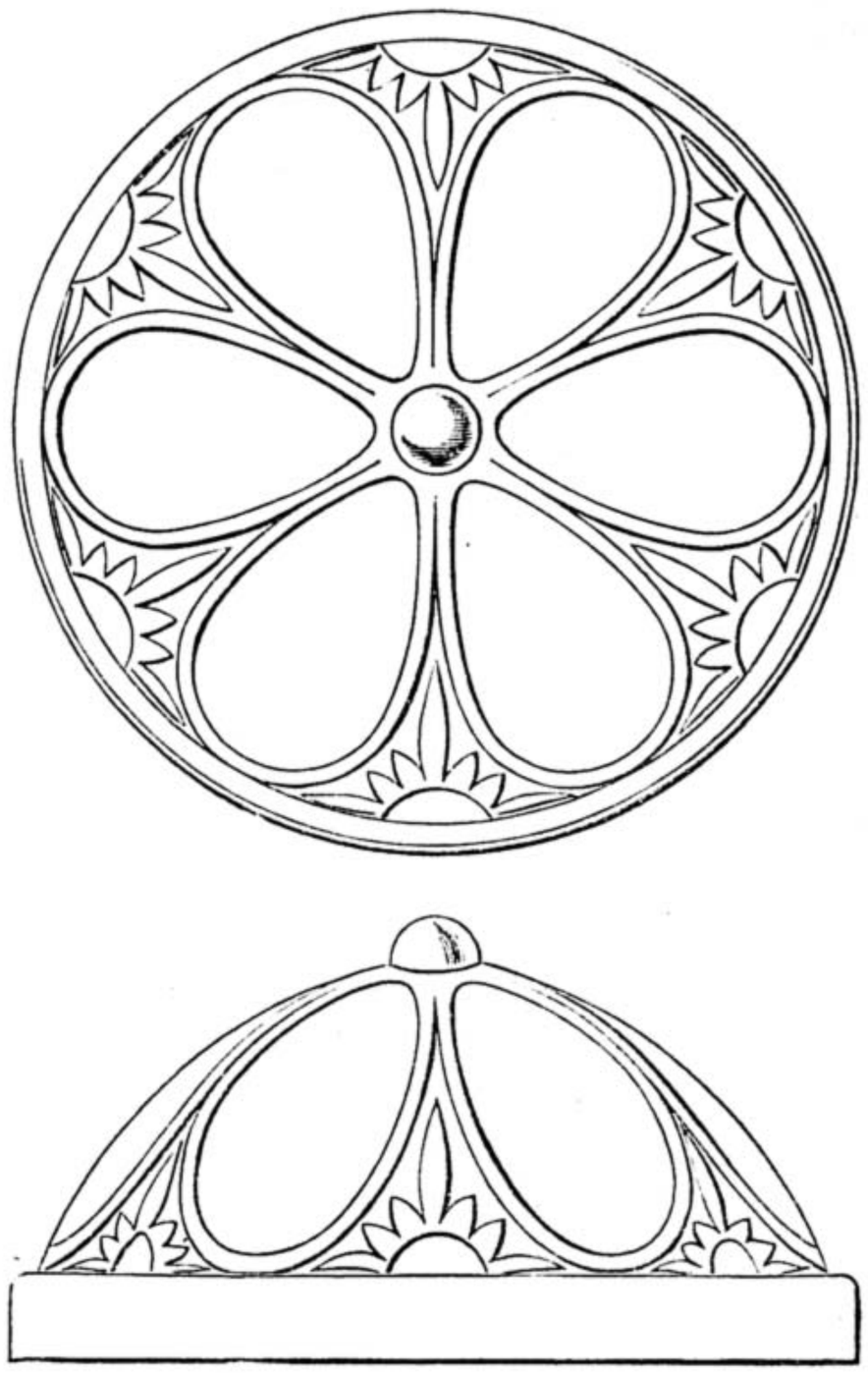


Fig. 4.—Boss on Nail Head.

English styles of the twelfth and later centuries.

It is believed that the elaborate wealth of scroll ornamentation of the classic style is a survival and evolution from an early period when the insides of the church doors were strengthened with a kind of armour plate, formed by the interlacing of bars, in the forms of scrolls and lozenge patterns. When the need for defence passed away, this wealth of ornament was transferred to the outside of the doors, often filling up and covering the whole of the space available between the hinges. An example of this elaborate ornament occurs in the cloister doors of Durham Cathedral.

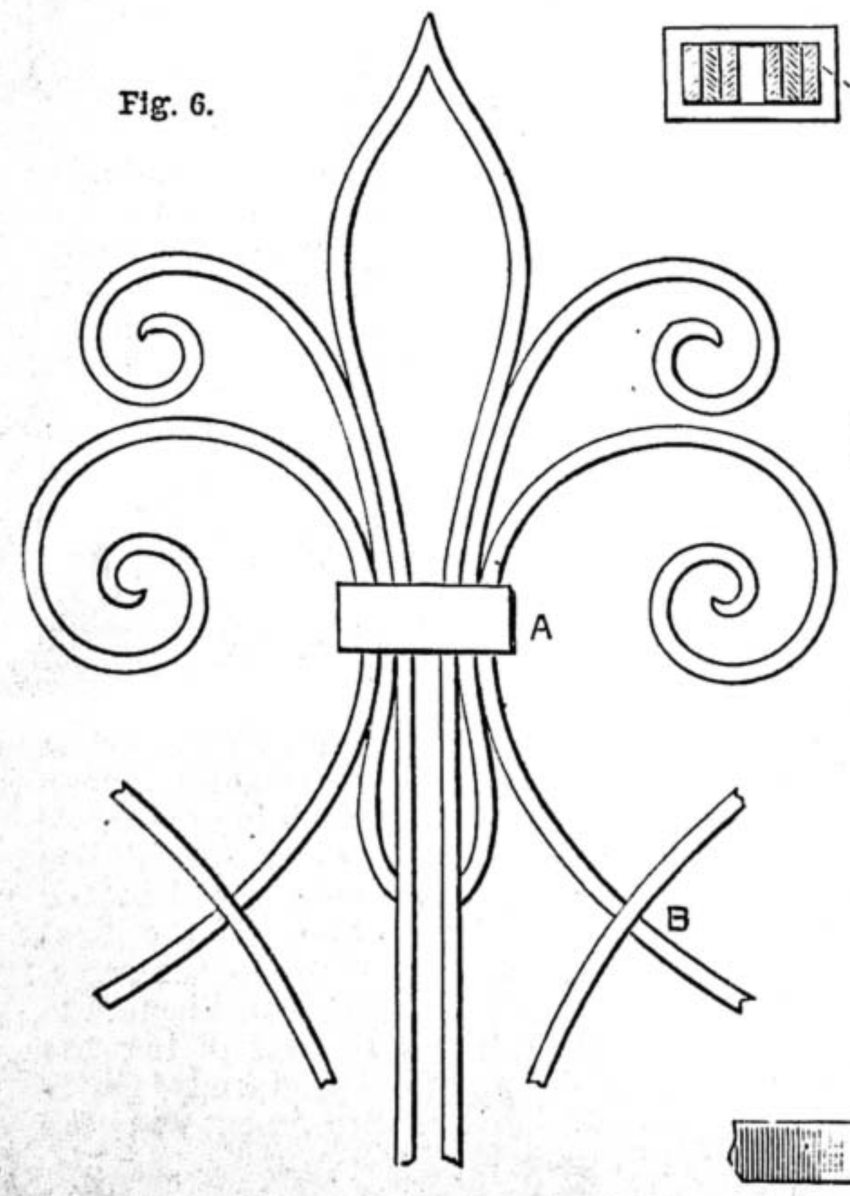
The ancient hinges were, therefore, not only beautiful but strong. Covering, as they did, the whole breadth of the door, they clamped its boards together so that there was neither any possibility of splitting the doors nor of wrenching them off their hinges.

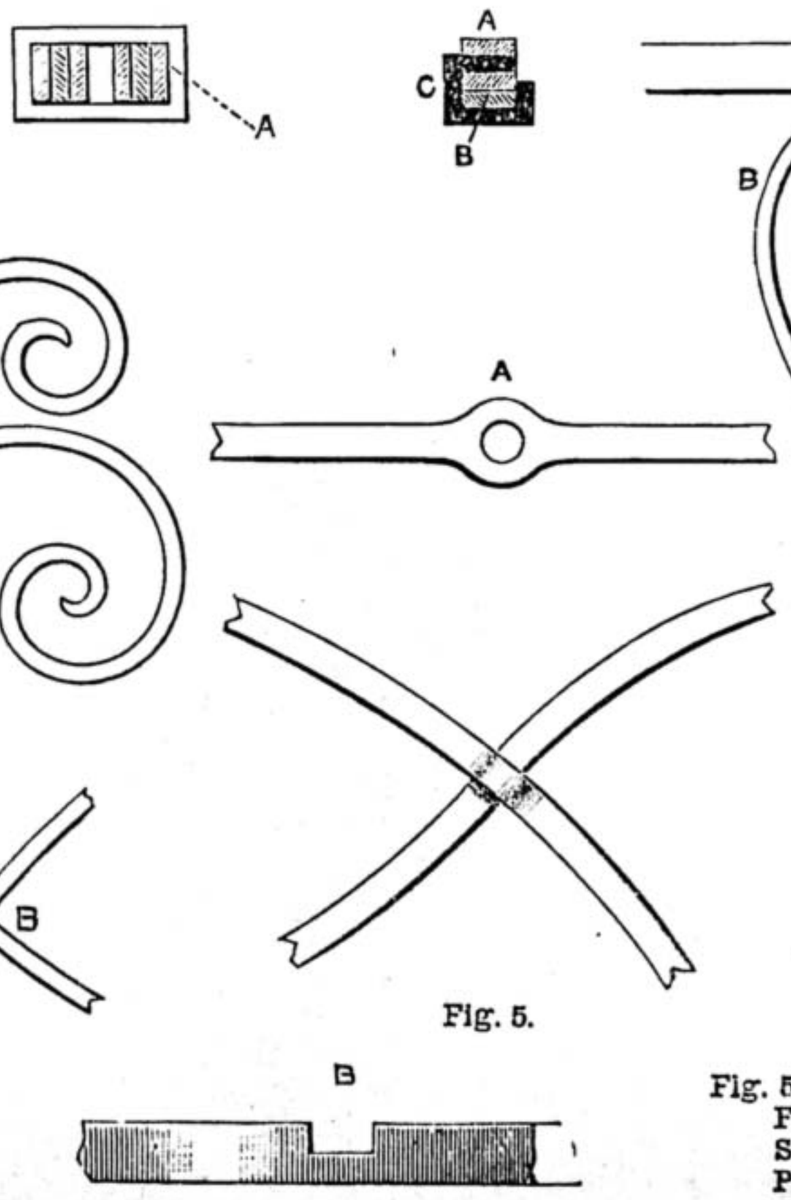
There are three principal styles of these ancient hinges: one in which the main straps which clamp the door together are flanked by curved straps of semicircular form; another in which the flanking straps are in the form of flowing curves; and a third in which they are foliated. Examples of the first kind occur on the hall doorway of Merton College, Oxford, shown in Fig. 8; of the second on the Church of All Saints, Leighton Buzzard; and of the third at Liège. Birds, dragons, and animals appear on many of the hinges. Those of Dartmouth church are remarkable—two huge animals, lions or panthers, covering the whole breadth of the door. The idea of the artist is evidently to represent them as among the branches and foliage of a tree, and, though stiff and conventional, the effect is very striking.

The English classic type of hinge consists essentially of a central stem or strap with branching scrolls, with or without intermingled foliage. Sometimes the scrolls are suppressed, and floriated ornament predominates. The vine is the plant which in conventional forms appears chiefly. It occurs in the horse-shoe and scroll forms, was common in England and France, and excellent examples occur at Leighton Buzzard, Eton, Bray, Uffington, St. Mary's, Norwich, St. George's Chapel, Windsor, Chester Cathedral, and the Chapter House, York. By the eighteenth century the lily, the thistle, and the passion flower had nearly superseded the vine in hinge work.

From the fact that there is great similarity between the hinges of the English and of the French churches, Mr. Starkie Gardner argues that the French works were made in England and exported. It

Fig. 6.





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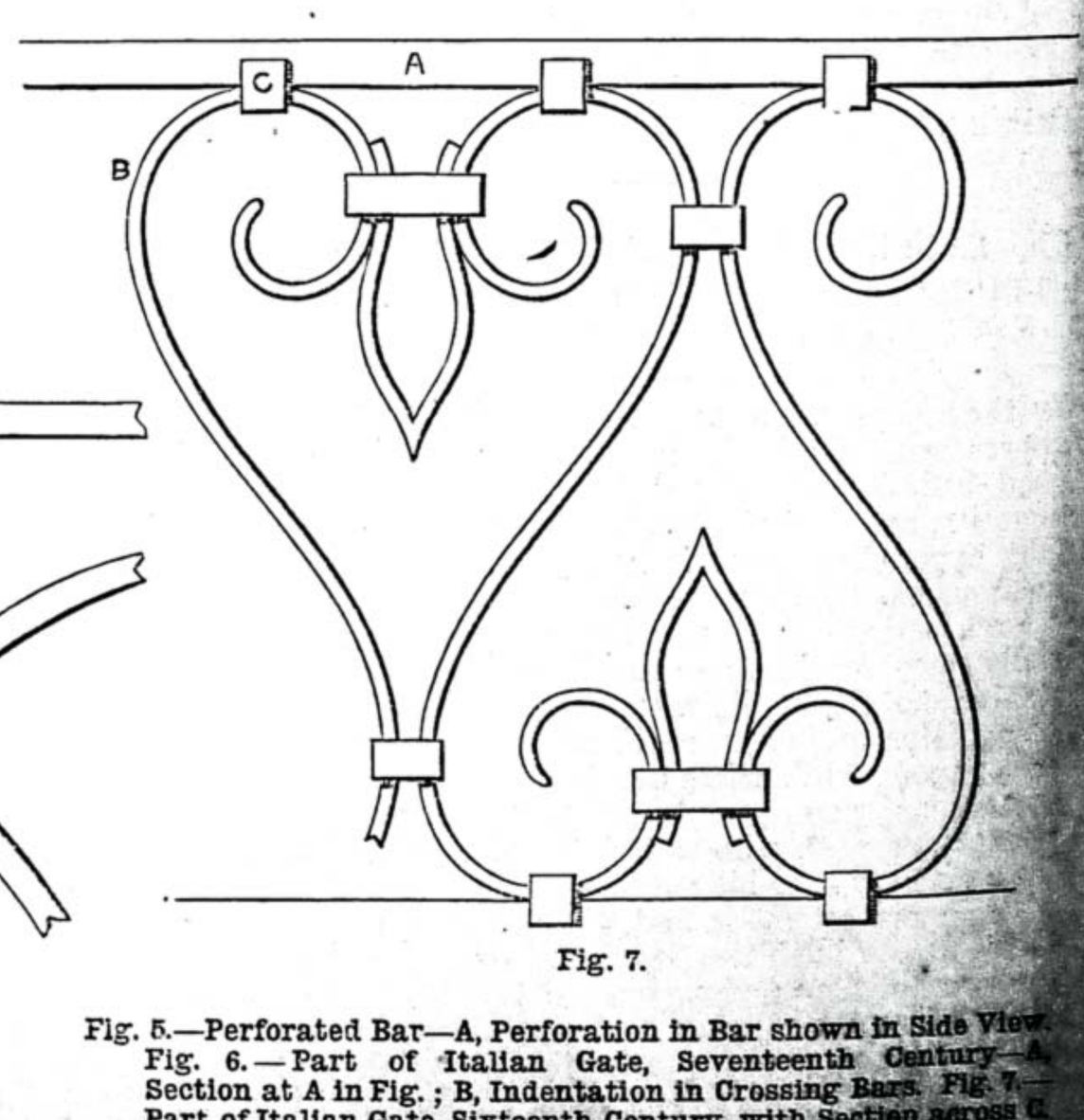

Fig. 7.

Fig. 5.—Perforated Bar—A, Perforation in Bar shown in Side View.
Fig. 6.—Part of Italian Gate, Seventeenth Century—A, Section at A in Fig.; B, Indentation in Crossing Bars. Fig. 7.—Part of Italian Gate, Sixteenth Century, with Section across C.

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is singular that no tradition exists of the origin of the vast hinges of Notre Dame in Paris, except that which ascribes them to the devil. If made in England, national pride might well cover their origin with oblivion.

Wyatt, however, says that the doors of Notre Dame were executed at the beginning of the thirteenth century. They are the largest in the world. In connection with these doors, Sauval, in his *Antiquités de Paris*, gives an account of Biscornette, a smith of the sixteenth century, who appears to have done some repairs to the doors of Notre Dame. He is said to have entered into a compact with the Evil One to obtain his assistance in the working of the hinges, but that when it was requisite to execute the centre door the diabolical help failed him, because through it the sacrament was wont to pass. This illustrates the wonder in which his productions were held by his contemporaries. The secret of his methods died with him, for nobody ever saw him work. Hinges similar to those of Notre Dame occur at Beauvais, Chartres, Nantes, Chalons-sur-Marne, and other towns.

It is often hard to say whether parts are drawn down out of the solid or welded. Both methods were in use, and different men would probably pursue different methods. Then there was a good deal of surface grooving, evidently done with a chisel, probably when the iron was cold or nearly so. The punch also must have been extensively used to produce the little depressions and tiny circular bosses which abound on the floriated ornament.

Examples of hinges occur all over England as well as on the Continent; few localities are without these relics of the past, and an hour may be profitably spent in a study of their details.

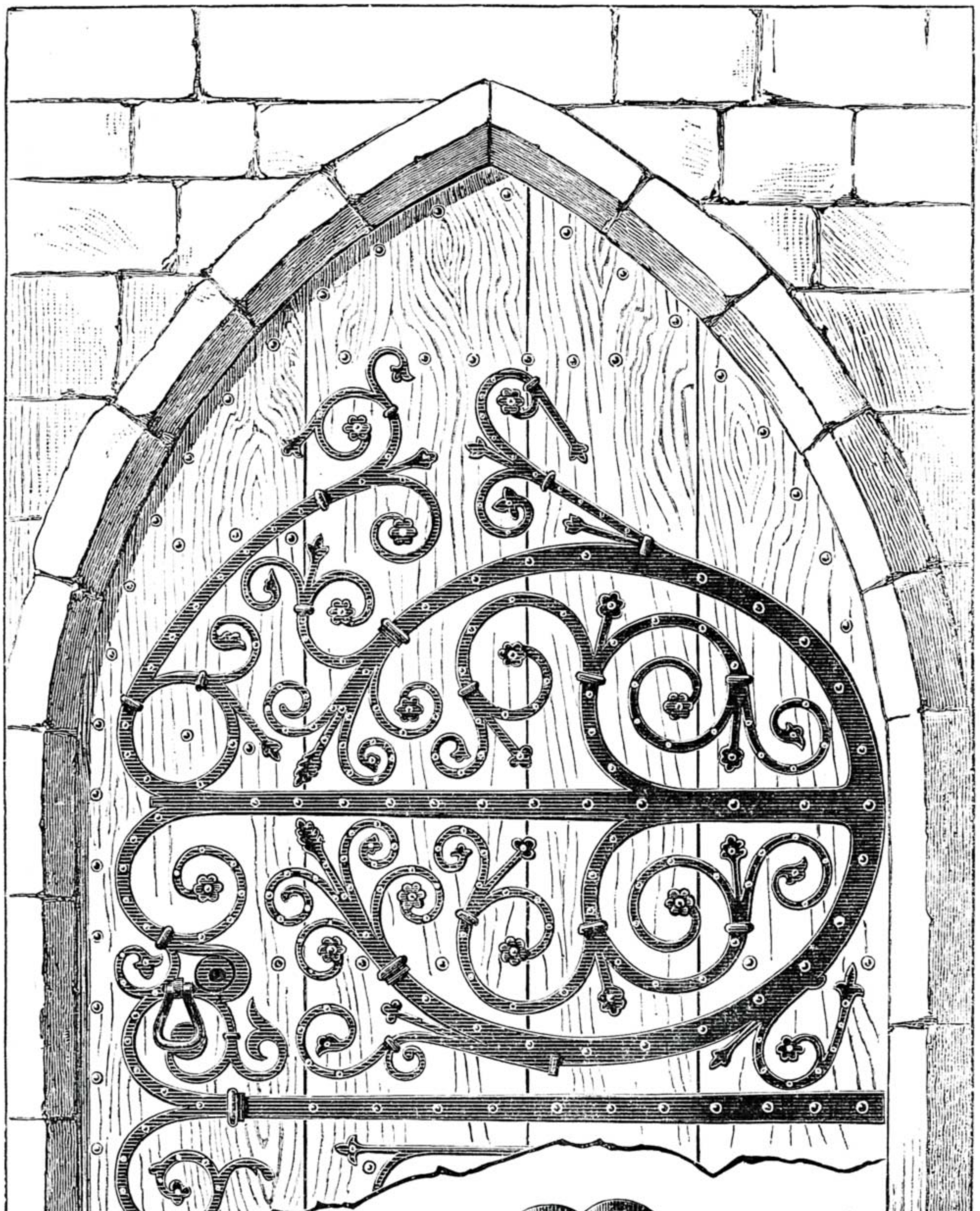

Fig. 8.

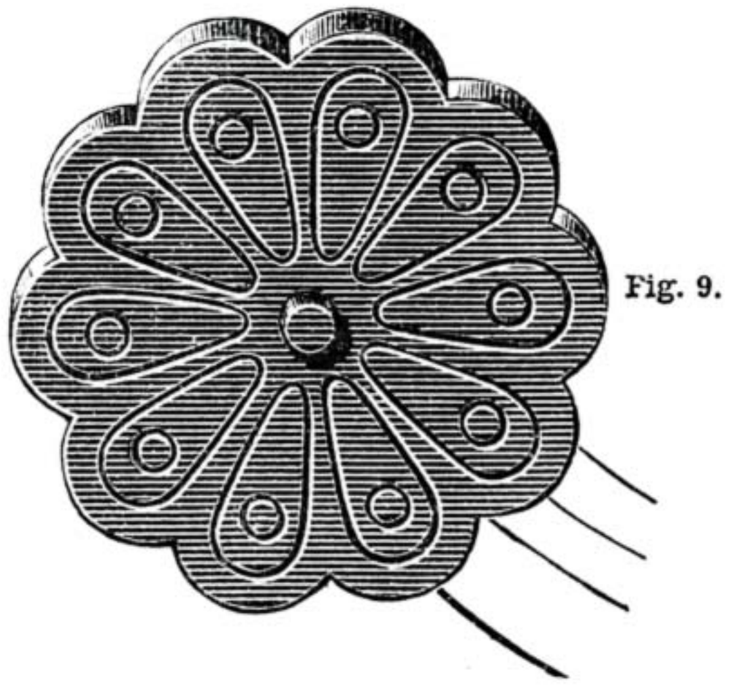

Fig. 9.

Fig. 8.—Upper Hinge on Door of Merton College, Oxford. The Lower Hinge being similar to the Upper Hinge, reduplication is unnecessary. Fig. 9.—Enlarged Sketch of one of the Bosses on Door.

More wonderful than the great hinges are the iron gates of mediæval and modern make. These are very abundant both in our own country and on the Continent. It is almost impossible to reproduce their lovely tracery except by photography. They must properly be seen and studied, for all description fails. The finest example in this country are the gates of the tomb of Edward IV. at Windsor, now inside St. George's Chapel, just beneath the Queen's pew, and within the altar rails. Formerly they stood without in the cloisters on the other side of the wall, and the sockets in the tombstone in the cloisters in which the gates were formerly stood are still visible, though now filled up. The work in these gates is of so elaborate and delicate a character that I am sorry not to be able to reproduce them entire as they stand.

Tenons and pins are the principal methods by which the several portions of these gates are held together. The main framework is very strong, and it is probably because of the massive character of the principal bars that cast iron has been thought to have entered into their construction. The vertical ribs are tenoned into the top rail or parapet.

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Upon this strong framework the compartments and canopies with their delicate traceries are attached. These canopies are crowded with the finest and most beautiful tracery, and I cannot conceive how they were formed except by stamping or by casting. It is of course impossible to say by mere inspection of the surfaces whether these are cast or wrought. They may be either; they are very smooth, but they must have been either cast, or stamped in dies, because it would be impossible to forge them by any mere sleight of hand. Immediately behind each of these bays there is a sheet of iron of about $\frac{1}{16}$th in. thickness, and to these sheets horizontal plates are attached, and these become the backing or supports for the delicate columns and tracery. Oblong holes are punched through the sheets, and tenons from the plates pass through and are pinned upon the back side. Tenons stand out from the brackets of the pillars, and passing through the plates are secured with pins above. These details are not apparent at a casual examination from the front, but have to be searched for.

Although some gates have a much plainer appearance than others, it does not follow that the more ornate specimens necessarily demanded greater skill than the simpler ones. Even the most involved work, when we come to analyse it, becomes resolved, if we may use the term, into very simple elements. The groundwork once built up, the rest is a matter of detail; tedious it may be, but nevertheless a question of time mainly. Matters of detail are repetitive; bars, scrolls, foliage are bent, swaged, riveted, welded, and where panels are multiplied the general uniformity proves the use of templets or dies. But the smiths loved their work, and so was its tedium beguiled.

Fig. 4 represents a frequent method of ornamentation adopted. It is a boss, or nail head, from a door in the City of Toledo, and is fifteenth or sixteenth century date. It is about 4 in. in diameter. Specimens of such *repoussé* work in iron must have been very difficult to make, although it is possible that if several were made at one time, a pair of dies may have been laboriously manufactured.

A method of crossing tracery which I have observed in several instances in bars of round section is by perforation (Fig. 5). A hole is punched through one bar, into which the crossing bar is threaded. The act of punching would spread the metal, without removing any, but in some cases it would appear as though the punched bar had been slightly upset before punching to keep the cross sections on each side of the hole about equal to that of the original bar.

The crossing of bars whose edges are in the same plane is often effected by means of half lap joints. Notches are cut out of the bars, each notch to one half the width, and of the same breadth as the thickness of the bar, and these fitting into one another give the appearance as of scrolls growing out of one another (see Fig. 6, B), which is a portion of an Italian gate of the sixteenth century. Bars of circular as well as of flat section are treated in this manner, and the joints are so close that they are only discoverable by close scrutiny. In the figure, A is one of the belts so common in work of this kind.

The method of attachment of the fleur-de-lis panelling to the cross bars in Fig. 7, which is that of an Italian gate sixteenth century, is shown by the section at the top left hand corner; portions of bar are bent to pass through mortises in the bar A, and embrace that portion of the scroll work B in contact therewith.

Fig. 8 is the upper portion of the very fine hinges on the doorway of the hall of Merton College. The lower portion being nearly a duplicate of the upper part, it is omitted in the drawing.

Fig. 9 is an enlarged view of one of the floral bosses of the hinges (Fig. 8), and well illustrates the style of the work.

There are two beautiful specimens of recent smiths' work in the South Kensington Museum. They are of Prussian make, and were shown at the Paris Exhibition of 1878. They are truly magnificent specimens of workmanship. Their finish is perfect. But they are not a whit better in this respect than the gates of the tomb of Edward IV. This is saying a very great deal indeed; for we must bear in mind the vast difference in the appliances for work available at the present day in comparison with those of five or six centuries since. Moreover, the work in the gates at Windsor is very much more delicate than that in these Prussian gates. These are however beautiful specimens of which every workman or firm should well be proud. It is extremely difficult to detect the joints. The heavier parts appear to have been tenoned, and the scroll work is bound with loops or with rivets.

Park gates and railings were executed in wrought iron before the use of cast iron became common. Specimens of large and comparatively recent gates occur at the Clarendon Printing Office, Oxford, and at Hampton Court, and at several localities about London. But with these we are scarcely concerned at present.

INDIARUBBER STAMP MAKING.

BY "QUI VIVE."

Mode of Working.

Assuming that we are about to make a straight line stamp, we proceed to set up the requisite type in the composing stick. We first take a piece of thin brass rule and form it into a "setting rule" (Fig. 14, p. 593). It is best to have a set of these of the respective lengths of 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, and 4 in. from *a* to *b* in the figure, the corner *c* being left projecting so that the rule may be readily removed from time to time, as required. Grasping the composing stick in the left hand, the back of the hand being away from the body, we select a setting rule from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. longer on its shorter edge than the length of our intended stamp, measured in the direction of the lines, and drop it by its shorter edge into the "stick," the slide *b* of which is to be adjusted to the length of the rule by means of the thumb-screw, *a*. Holding the "stick" with the corner marked *c* somewhat elevated, we take the type answering to the first letter of the stamp we are about to make and insert it, face upward and with the nick or nicks which will be found on one side of the type towards the open side of the "stick," in the corner of the "stick" marked *d*. The type so placed is retained in its place by the thumb of the left hand while the type next required is selected and placed in position, and so on until the first word is completed, when a "space" of medium thickness is placed in the stick to separate the first word from the second, which is set up or "composed" in the same way. When all the words forming the first line have been set up we "justify" the line by inserting "quads" or "spaces" as may be required at each end of the line so that both ends of the line of type may be equi-distant from the sides of the composing stick. We now insert a "lead" of suitable length, and then removing the setting rule from its original position we place it upon the "lead" just placed, and proceed with the setting up of the next line, and so on until the entire stamp or series of stamps has been set up. If any adjustment of the spaces between the lines should be considered necessary, this may now be done by inserting additional leads or pieces of "reglet" where required. Great care must be taken to set the type upright on their "feet," as the end opposite to the face is called.

The type has now to be transferred to the "chase," which is prepared to receive it as follows. The chase is placed on an inclined plane, such as a desk lid, with the corner *a* (Fig. 2, p. 593) uppermost, that is, in the position occupied in the figure by the corner *b*. A 6-in. length of the narrow "furniture" is then laid against the left-hand side of the chase—inside, of course—followed by a similar length of "wood rule." Pieces of "furniture," "wood rule," and pica "reglet" of the same length as the setting rule we have been using are next laid in order against the bottom side of the chase. The setting rule is now placed in its first position in the composing stick and a lead placed against the line of type last set. The type, etc., are now firmly grasped between the fore-fingers and thumbs of both hands and carefully slid out of the composing stick, the remaining fingers being used to prevent the type from falling sideways out of their proper place. Still grasping the type firmly they are steadily lowered into their position in the lower corner of the chase. We next apply lengths of reglet, wood rule, and furniture similar to those already used to the unprotected sides of the type, and then proceed to fill up the vacant portion of the chase to within 1 in. or $1\frac{1}{4}$ in. of the upper side and end, taking care to so arrange matters that the type shall be as nearly as possible central in the chase. Finally, we place "side sticks," broad ends towards the lower sides and taper edges outward, against what we already have in the chase, and with a couple of suitable "quoins" to each side stick wedge the whole together slightly with the fingers. Our work must now be carefully examined to discover and rectify any mistakes which may have been hitherto overlooked, after which the "forme" of type is "planed" by placing thereon a perfectly level piece of some hard wood, such as beech, and while moving it about on the face of the type, gently striking it with a wooden mallet. Any leads or spaces which may have risen during the planing operation are now to be carefully pushed down and the "forme" firmly "locked up" by driving the quoins with the mallet, a spare side stick being used in the absence of a proper "shooting stick" for the mallet to strike upon. A little petroleum is now lightly brushed over and into the interstices of the type, and we are ready for the next operation.

We have now to prepare the mould. For this purpose we shall require a supply of the finest plaster of Paris, and of the "moulding composition" sold for the purpose by all the wholesale stamp-making firms, also a thin solution of dextrine in water. We must also provide ourselves with a "palette knife" (Fig. 11, p. 593), a jam pot or some similar article, and a flat piece of slate, with a piece of fine cambric or muslin, a little smaller than the inside of the chase in which our type has been secured. Having all our materials by us, we take a small lump of

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the moulding composition and knead it well on the piece of slate. This done, we take about as much plaster as we have of compo, and mix it in the jam pot with sufficient dextrine solution to form a thick cream, which must be immediately well mixed with the kneaded compo by means of the palette knife. This mixture should be moderately stiff, but not so hard as to crumble, and should be capable of being spread on the *under* surface of the moulding plate with the palette knife. This we now proceed to do, the moulding plate being turned "wrong side up" for the purpose. The layer of composition should be laid fairly level, and about $\frac{1}{8}$ in. in thickness. A little petroleum should now be applied to the bevelled faces of the moulding gauge, which should then be placed on the moulding plate and slid backward and forward over the composition until the layer of compo is rendered perfectly level and free from cracks or holes. The piece of cambric or muslin must now be laid on the face of the type, and the moulding plate with the composition on its under surface placed in position on the chase. Both chase and moulding plate are then placed in the press, and the platen lowered until a light impression, showing the general outline of the stamp, is produced. The cambric will, of course, prevent anything like a *clear* impression; but this must now be removed, the type once more oiled, and an impression taken with the naked type. This should be repeated several times, each impression being made slightly deeper than the preceding one. The entire operation should be so timed that the final impression is taken when the compo is beginning to set, but the actual time required can only be learned by experience, as it varies with the condition and mode of preparation of the materials, the temperature and dryness, or humidity of the air. Assuming our operations to have been successful, we shall now be in possession of a mould which is the exact counterpart of the type from which it was taken. This mould should now be carefully examined for errors, for although a careful examination of the forme was made before we began our moulding operations, such an error as the reversal of a type may have escaped our notice through the forme being itself reversed. Now, however, the mould shows everything right way up, and so enables us more readily to detect errors which may have escaped previous notice. Should an error be discovered another mould must be made. The mould is not yet fit for use, but must be most thoroughly dried, as any moisture remaining in it would most probably lead to its destruction during the vulcanising process. The drying must be done very gradually to prevent the splitting of the mould by the too rapid generation of steam. It is effected by placing the plate bearing the mould face upward on the brackets attached to the press, and placing a suitable gas-burner underneath; one of Fletcher's numerous patterns will be found to answer the purpose admirably. Another burner may with advantage be used to heat the press simultaneously with the drying of the mould. In order to protect the mould from dust during the drying process, it is advisable to cover it with a bent piece of sheet iron or tin. When perfectly dry—which may be tested by laying any cold polished surface in momentary contact with the mould, and observing whether or not there is any appearance of steam on it upon its removal—the irregularities of the surface, if any, are rubbed down with a file or a piece of sand paper wrapped round a flat piece of wood or cork as used by cabinet makers in smoothing their work. All dust produced in this levelling process must be carefully brushed and blown away. This done, the mould is lightly but thoroughly brushed over with a little French chalk, all traces of dust being carefully removed as before.

Our mould is now ready for the rubber. This is prepared in sheets about $\frac{1}{8}$ in. in thickness, and may be procured from the same sources as the moulding composition. Take a piece of the prepared rubber, somewhat larger than the required die, and brush it carefully on both sides with French chalk. Take also a piece of smooth tin plate about $6\frac{1}{2}$ in. by $4\frac{1}{2}$ in., and well rub it also with French chalk. The heat of the apparatus should now be looked to. The press, the platen of which should have been firmly screwed down, should be heated to about 290° F., and the moulding plate should be so hot that drops of water allowed to fall on it from the finger tips roll off without spreading or leaving any trace, but should not be hot enough to blacken a shred of the rubber compo laid thereon. Both press and moulding plate being properly heated, the platen of the press should be raised about an inch. The prepared piece of rubber is then to be laid on the mould and the smooth piece of tin plate on the rubber. Now slide the whole into the press, and as soon as the temperature, as shown by the thermometer, has fallen to 285° F., screw the platen down into gentle contact with the tin plate, and gradually increase the pressure as the rubber is felt to yield. When well pressed down leave the press untouched for from twelve to fifteen minutes, unless the temperature shows a tendency to rise, in which case extinguish the gas-burner, and complete the operation without the gas being further used. The rubber should now be removed from the mould, and will probably be found of a dark drab or slate colour, solid, and extremely elastic, showing that the operation has been successful. If, however, the rubber remains light-coloured and soft, readily retaining the impression of the finger-nail, the temperature has been too low; if black or hard, the temperature has been too high; if spongy, the pressure has been insufficient. In either case the vulcanising process must be repeated with a fresh piece of rubber, and such modifications of the process as are indicated by our previous experiment. The finished die may be washed, if necessary, with water and a moderately stiff nail-brush. It is now ready for mounting, which may be effected by the aid of a solution of shellac, such as that used for fastening down linoleum, a small addition of methylated spirit being made if the solution should be found too thick. The mounts may be procured at any of the wholesale stamp shops.

My task is now complete, and I conclude with the hope that all who attempt the manufacture of indiarubber stamps from the foregoing instructions will be as successful as I have been; they are certain to find it a fascinating occupation.

LATHES FOR EVERYBODY.

BY SELF-HELPER.

A Good Wooden Lathe for Carpenters—The Fixed Headstock, Poppet, and Hand-rest.

I WILL take for the subject of this second paper on lathes one which I designed, and partly constructed, for a clever carpenter of my acquaintance. He wished to have something more beautiful-looking and better finished than the somewhat crude machine I described in the first paper of this series, and I was willing to comply with his wishes. For the woodwork I recommend good seasoned mahogany, thoroughly baked, so that there will be little chance of its shrinking and warping when the machine is finished. Every part should be most carefully made, and worked at with plane, file, and sandpaper until it is as smooth and true as the finest piece of cabinet work. It should then be French-polished, which will serve the double purpose of giving it a nice finish and stopping the pores of the wood to prevent them from absorbing moisture, and thus swelling and throwing things out of truth. If mahogany is judged to be too expensive for the entire lathe, the headstocks, or at least the running headstock, might be made of it, and the rest of some less expensive wood—beech, say, or any other hard wood not prone to warp.

My friend used beech largely, and the machine is giving every satisfaction after more than two years' work.

The important thing is to have the wood quite dry, so that it will not warp, and, when finished, to French polish, or varnish, so as to stop the pores.

I will not enter here upon the various advantages and disadvantages of wood and iron as materials for lathes. It will be very evident to any one who considers the matter carefully that many people would be debarred entirely from the possession of a lathe if it had to be made of cast iron, while others of an engineering turn would find it equally difficult to make a good job of wood.

The entire efficacy of a wood-turner's lathe depends upon the truth of a few parts, and, if these are right, it matters little as to what the rest is made of.

I will be somewhat more particular in describing this lathe than I was in the first paper, both because it is a more worthy subject, and also one or two correspondents complained that, in my last, I did not enter enough into details. I will, therefore, describe in order the construction of the (1) fixed headstock, (2) the poppet, (3) the hand-rest, (4) and the stand, including fly wheel, treadle, etc. I follow this order because the first mentioned is the most difficult; and, therefore, if a man succeeds with it, he will find the rest of the work comparatively easy; while, if he finds it beyond his power, he can pitch it into the fire and get rid of the whole thing without having the mortification of breaking up the stand also. If he began with the stand, he would probably succeed in making it, and perhaps not find, until too late, that the headstock was beyond his power.

If any of my readers, however, are fairly handy with tools and persevering, there is no fear of their failing. I may say that the height of centres is 5 in. and the bed is 5 ft. long. Figs. 1 and 2 are side and end views respectively of the headstock. It consists of four pieces of wood, all truly planed to 2 in. thick. Two of the pieces are like Fig. 2; of the other two, one is 12 in. long and 5 in. wide, and one is 12 in. long and 4 in. wide. The figures show how these pieces are mortised together. The wide piece has two tenons passing into each end, and the narrow piece at right angles to that has two others, so that there are four mortises at each end, each mortise being about $\frac{3}{4}$ in. by $1\frac{3}{8}$ in. This work cannot be too carefully done, as on it depends the whole perfection of the lathe when completed.

The two long pieces which are at right

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angles and form the base of the headstock should fit closely together, and be glued, and, as an additional security, I passed a couple of ¼ in. bolts from the top down, as shown in Fig. 1. I may mention, in passing, that I used engineers' bolts with hexagon heads, which were turned and burnished.

When my carpenter friend brought this job to me (for I got him to do the woodwork at home, I acting as architect and engineer), it did not please me at all. The tenons did not fit perfectly, as they should do, and the shoulders were in some places so far from their bedding that I could put the corner of a sheet of paper between; the whole, in fact, was not as one piece.

I accordingly, after growling a bit, sent him to the forge to get two pieces of iron made like Fig. 3. I then set him at them with a file until they were quite flat and smooth, and with the edges nicely bevelled at one side of each, so that they could be placed one at each side of the headstock. They were secured by six ⅜ in. engineers' bolts. I may mention here that when the headstock was finished all but the polishing, I took the iron plates off and japanned them while the woodwork was being polished. This japanning I executed by covering the irons thickly with black japan and putting them in the kitchen stove until they were quite hard, black, and shiny. They were very satisfactory.

The holes for the bolts I drilled in the lathe, half from each side of the headstock, as it requires some care to have the plates exactly in the correct positions. Some would prefer to sink these into the wood, but I let them stand out. They

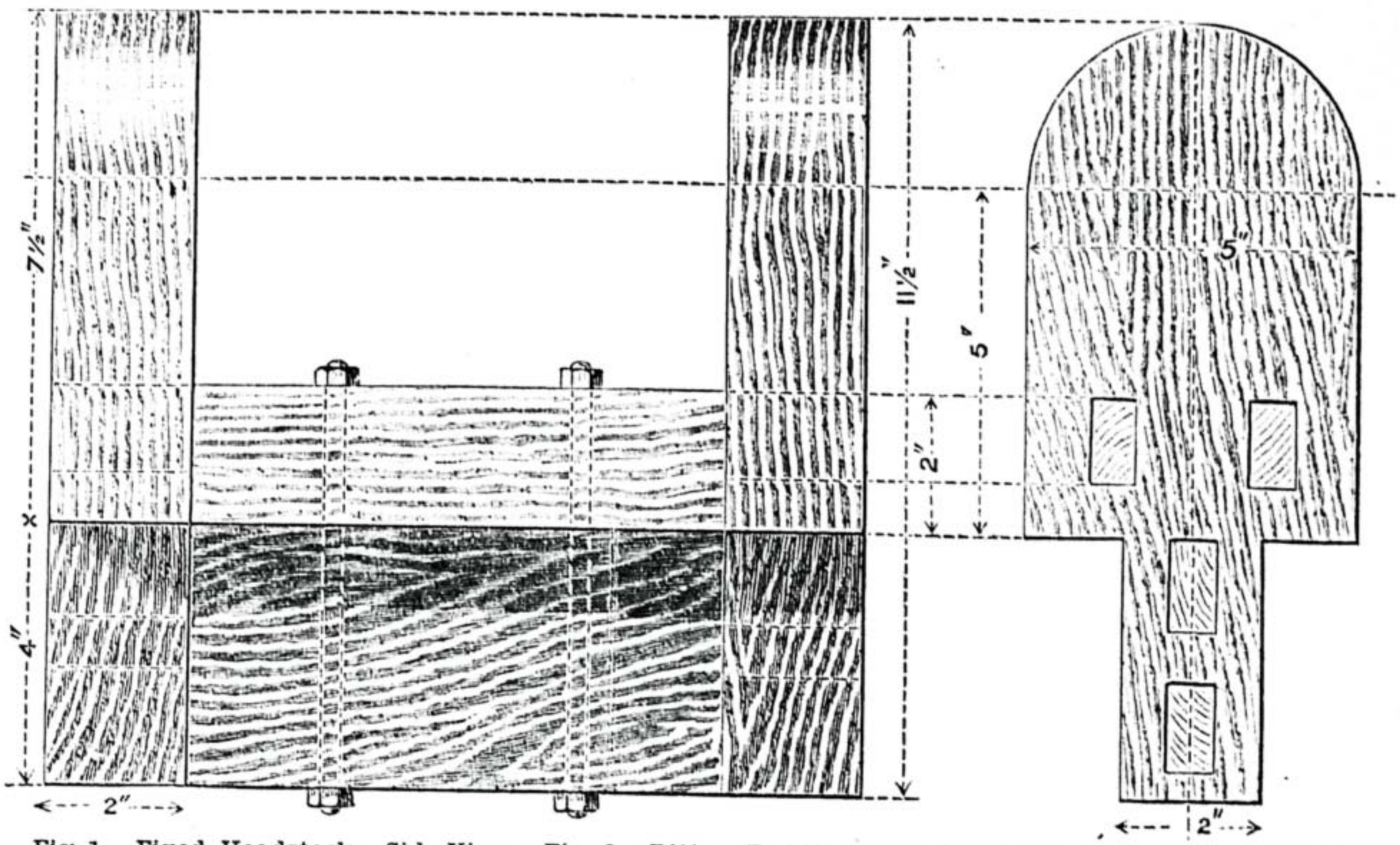

Fig. 1.—Fixed Headstock: Side View. Fig. 2.—Ditto: End View (two like this). Scale, 3 in. to 1 foot.

are made of iron 1½ in. by ⅜ in. If the mortising of the parts of the headstock be properly done, these iron strengthening plates would be unnecessary. I mention them here lest any one should make a mess of his work and be tempted to give it up. The mortising will be of secondary importance if the plates are used.

The next part which I shall describe was most distinctly my own work. It is shown in Fig. 4, and consists of the mandrel, collar, tail screw, and its two screwed plates.

The mandrel (M) was turned from a solid piece of Bessemer steel 8¾ in. long. The dimensions are as follows:—

Nose, ¾ in. long, ¾ in. diameter, screwed Whitworth; front cone, 1¾ in. long, tapering from 1 in. to 1¼ in.; next cone ½ in. long, tapering from 1¼ in. to 1½ in.; body, 6 in. long, ⅞ in. diameter.

The tail screw is cast steel, 6 in. long and ¾ in. diameter.

The collar (C) is made of gun-metal; the hole is coned to fit mandrel perfectly, and turned to 1¾ in. in the front parallel part, while the flange is 4 in. in circumference and ⅜ in. thick.

The two plates for the tail pin are also gun-metal, the flanges being 3 in. diameter by ¼ in. thick, and the body 1⅛ in. bored out for ¾ in. screw. All the flanges are round, so that they could be turned in the lathe. They were also nicely finished with beer and a burnisher.

The mandrel has a piece of cast steel let into the tail end, which is hardened, and thus wears much longer than the soft Bessemer steel would. Note the small hole in the centre so that the point of the screw (s) would not wear away.

To make the mandrel, cut off a piece of steel or iron the required length, viz., 8¾ in.; then centre it truly at both ends, bore a ⅜ in. hole 1 in. deep, and plug it with a piece of the best cast steel, turned, and with the centre upon which it was turned outwards. Then enlarge the

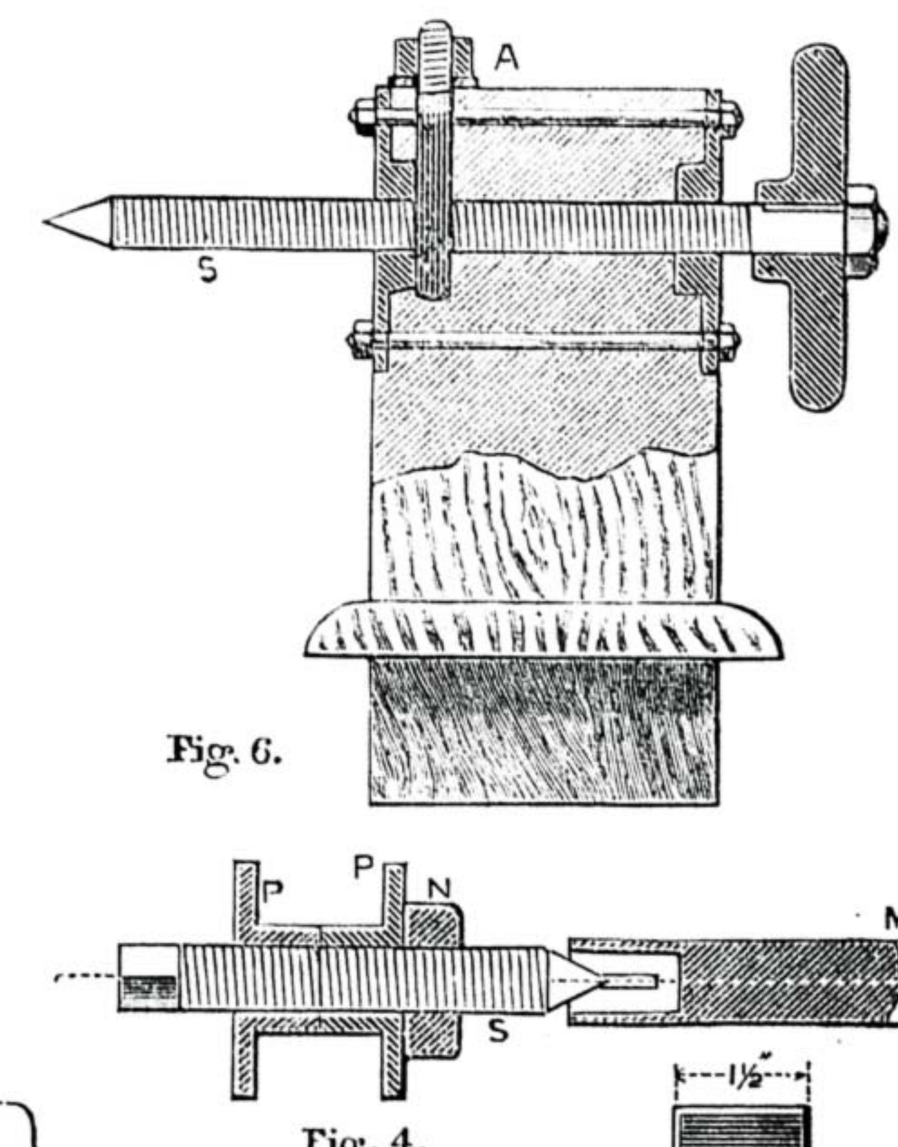

Fig. 6.

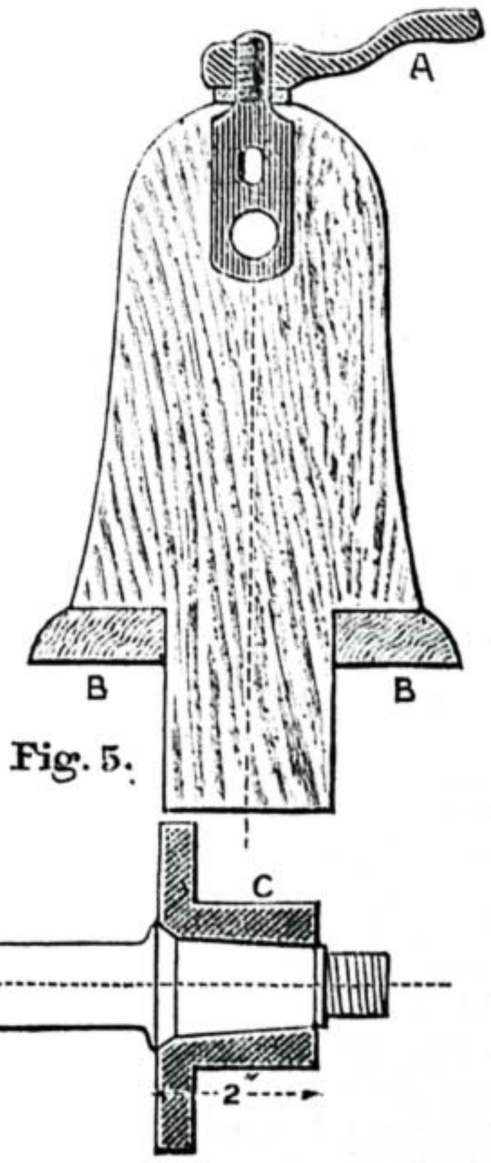

Fig. 5.

Fig. 4.

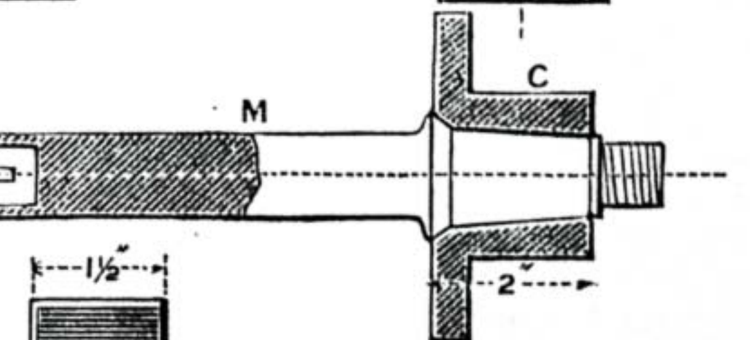

Fig. 3

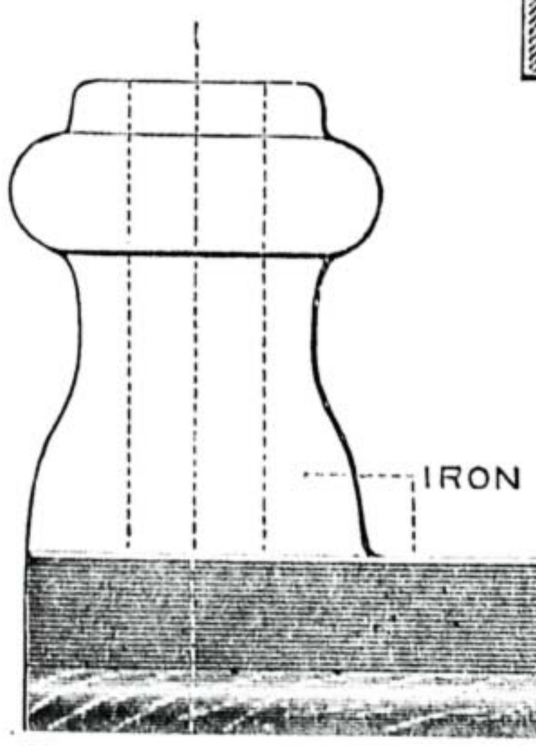

Fig. 7.

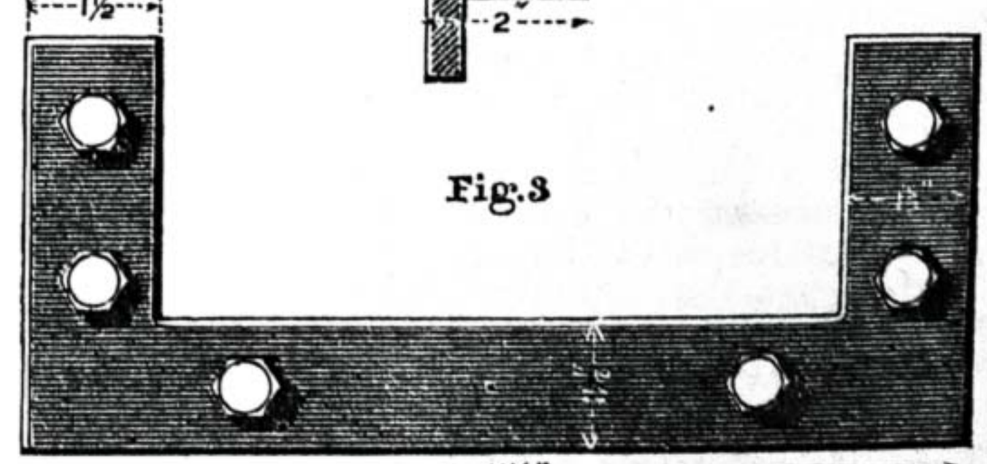

Fig. 8.

Fig. 3.—Iron Stay for each side of Headstock, ¾ in. thick. Fig. 4.—Mandrel, etc.—M, Mandrel; C, Collar; S, Tail Screw; P P, Plates; N, Lock Nut. Fig. 5.—Poppet: End View—A, Locking Handle; B B, Slip. Fig. 6.—Ditto: Front View—S, Screw. Fig. 7.—Hand-rest. Fig. 8.—Section of Hand-rest. Figs. 3, 4, 5, 6, scale, 8 in. to 1 ft. Figs. 7, 8, half full size.

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hole in the cast steel until it is about ⅛ in. outside and tapering to an angle of 55°. The little hole in the centre should previously have been bored about ⅛ in. diameter and ¾ in. deep. The best way to taper the hole is with a rosebit made to the correct angle and running truly in the lathe.

Next harden the centre by heating the end of the bar to a bright cherry red and plunging into water. All that remains to do now is to turn the mandrel to the required dimensions given above.

The casting for the collar (C) is chucked in a wooden chuck, bored out inside to fit the mandrel, and then the outside is turned while it is running on its mandrel. If there is a tendency to loosen, as there probably will be, a nut and washer could be put on the nose during most of the turning, and it will effectually prevent the collar becoming loose.

The tail screw is turned from 6 in. of ¾ in. square steel; ¾ in. is left square at one end, and the other end is tapered to 55°. The screw ought to be cut in a screwing lathe.

The plates are of gun-metal, and are turned like the collar on their own screw, or they might be run on the nose of the mandrel and turned there, the screw being the same. I may mention that four of these plates will be required, two for the poppet and two for this part.

The collar is let in flush with the wood of the headstock, so that its two inches of length will bring the front end flush also with the front of the headstock.

I may mention here that the mandrel projects nearly ⅛ in. beyond the collar before the shoulder is reached. This is shown plainly in Fig. 4, but it is not quite so plain that the mandrel is sunk in at the back what it projects at the front.

The pulley was made of a piece of ebony, the largest of the four speeds being 5 in. and the smallest 2 in. It was covered at each side with a plate of gun-metal 2 in. diameter, and nicely turned and polished; the speeds were each ½ in. wide, and would take ⅜ in. gut, but ¼ in. was quite enough.

The mandrel, with its collar and tail screw, might now be inserted in the headstock, but there would be a greater chance of accurate work if this were postponed until the framework is completed, which we will therefore do.

I may say that, if the mandrel and the other engineering part of the work are beyond the power of any of my readers, most engineering firms would supply them complete for a comparatively small sum. The Britannia Company, Colchester, will send an estimate on referring them to the number of WORK in which this appears.

The Poppet.—This is simply a block of wood 4 in. by 3½ in. and 9 in. long. It is shaped somewhat more beautifully than the fixed headstock, as can be seen in Fig. 5.

The screwed plates can be seen in Fig. 6, through which the long tightening screw passes, the latter 8 in. long, ¾ in. diameter, with a hand wheel keyed and nutted at one end and tapered at the other. It would be better if the bosses were turned out instead of in, as shown, and the castings need not be sunk into the wood; they are secured by a couple of ¼-in. bolts passing through both. The locking arrangement is peculiar and satisfactory. A piece of iron 1⅛ in. × ⅜ in. fits into a mortise cut in the poppet to receive it, as shown in both figures, and the screw passes through a thread cut in it. It is evident that the tightening of the locking handle will effectually jamb the screw. It is well to have this arrangement near one of the washers, for, if it were half way between them, it would tend to bend the screw.

Another thing to be noted is the slips shown at the shoulders. I find that an end grain never runs very well along the bed, and so I hit on the plan of having a slip at each side with its grain at right angles to that of the poppet, which makes it run smoothly.

Every part of the poppet should be most carefully finished as before, the woodwork as smooth as glass and highly polished, and the iron and brasswork burnished, the spokes of the hand wheel being japanned.

I have gone somewhat too quickly, though, in describing the poppet with metal work all complete. The position of the screw can best be found, as in the other headstock, when the frame is made. I will, therefore, suppose that the iron and woodwork are separate until then.

The Hand-rest.—It is difficult, if not impossible, to make a satisfactory hand-rest socket of wood only. I therefore got castings for the socket and T's., but an ordinary 4½ in. socket, price about 1s. 6d., would do very well. I got the sole filed true, and the entire casting cleaned nicely. Then I bored the hole ¾ in. diameter for T's, and fitted a ¼ in. set screw, and japanned. I was afraid that the iron sole would bruise the bed, and so I fitted strips of wood ½ in. thick to the sole, fastening them on with screws tapped into the casting. This effectually prevented any bruising taking place. The T's were turned in the shank and then filed up and japanned, the shanks and tops being left bright. One was 8 in. long and the other 4 in., the shanks being 4 in. long in each case.

Figs. 7 and 8 show the socket all except the set screw, which is partly at the side, fitting into the ring seen near the top.

In another paper I hope to describe the frame, fly wheel, treadle, and how the position of mandrel and screw are to be determined, and to give a drawing of the complete lathe.

WATCH REPAIRING.

HINTS FOR AMATEURS WITH FEW TOOLS.

SHOULD a lever watch go too fast or slow when the regulator is at the extreme point, unscrew the cock, and unpin the spring from stud; if too slow, gently turn the collet (that part which holds hair spring to balance staff) so that the point end of spring goes ¼ of an inch, say, nearer to A from B (Fig. 1), then replace so that end of spring will be that distance also from the mark you made on plate, as stated in the cleaning of watch, in pages 517 and 583. Now repin it to stud on top plate, and replace cock, and screw down; listen now if it is in beat—your ear will be in practice now, and should be able to detect when out of beat. When I go into a friend's house and hear at once the clock out of beat, how it jars on my nerves! I must set it right before I can rest. How people can endure or not know passes my comprehension. I need scarcely tell you if the watch goes too fast; do the reverse to what I state above: turn towards B.

Should the spring be pinned in extreme length, the best plan is to unpin spring at collet—this is risky for amateurs, but try it; a new one will only cost a trifle—and with a small cork pointed just press it on the inner coil on a fine oilstone; a few rubs will reduce it, and, of course, weaken it; now repin it carefully and level; do not turn collet; now refix to stud on top plate to mark made, and screw down cock; it will now go slower and require regulating. Lever watch rubbing causes it to stop and go on again, thereby destroying its time-keeping qualities; listen to it, and you will hear a rubbing and chafing noise: this often proceeds from the one side of hair spring being set out of truth, not level all round the balance, and, of course, touching occasionally the balance in its vibrations, gives an unsteady motion and occasionally stops the balance, which in a short period, by motion of the wearer in walking, starts it again with perhaps a loss of time, several minutes. It is very annoying to the wearer. The remedy is a very easy matter. Draw out the pin and cast it away; proceed, and make a neat, carefully-pointed new one,

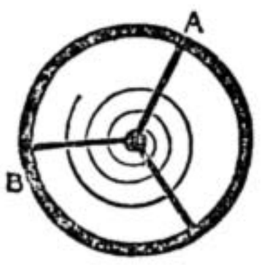

Fig. 1.

Fig 3.

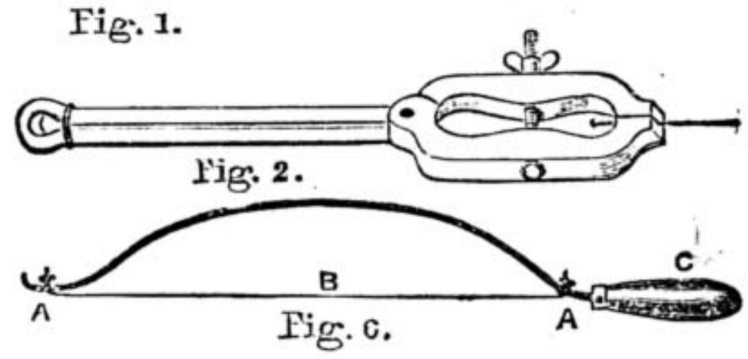

Fig. 2.

Fig. c.

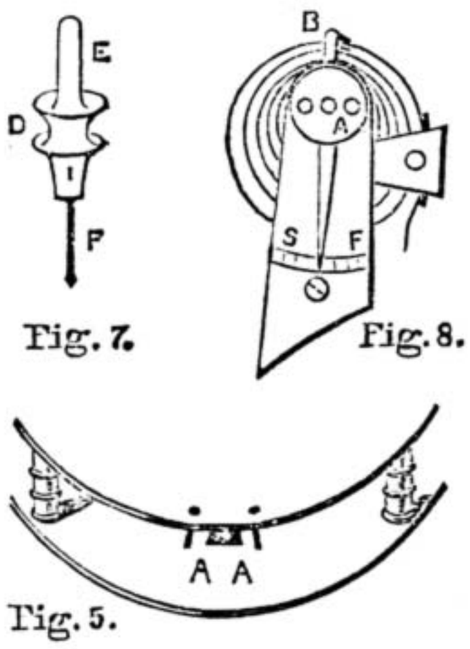

Fig. 7. Fig. 8. Fig. 5.

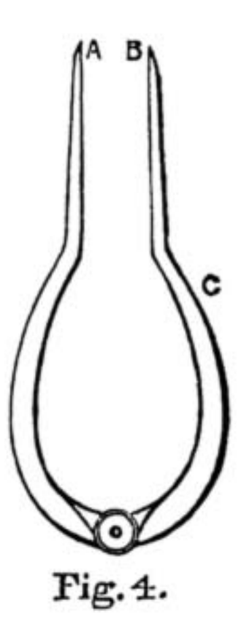

Fig. 4.

Fig. 1.—Hair Spring and Balance Staff. Fig. 2.—Pin Vice. Fig. 3.—Repairing Broken Tooth of Toothed Wheel. Fig. 4.—Tool made of Common Soft Compasses for adjusting Escape Wheel. Fig. 5.—Top Plate—A A, Banking Pins. Fig. 6.—Drill Bow—A A, Holes for Gut; B, Gut; C, Handle. Fig. 7.—Drill—D, Reel; E, Top; F, Drill. Fig. 8.—Regulator—A, Circular Part; B, Pin.

nice taper, not stunted: this is done by filing well back; see that hair spring now lies level; if it does not, when unpinned take balance and spring out, and gently draw down the side until level; when at rest, use the tweezers, not your fingers, or moisture may rust the spring. Now replace and fix with new pin, and it will be, no doubt, quite level; replace cock gently on to top pivot, screw down while the balance is vibrating, as this ensures you that the pivot is not being injured. Listen to the movement at work, and the rubbing will be gone.

Same applies to horizontal movements as well, except spring is on the top of balance; in this case it often happens that spring rubs against the cock.

Broken Ruby Pin.—This job an amateur cannot do; but take it out as described in page 583, and hand it over to the watch tool shop jeweller, who in nearly all cases

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does them for the trade; the charge will be reasonable, being quickly done by those accustomed to that special work.

Broken Pivots.—Do as above, because you could not make a clean job even if you had the tools, which are costly. Many who have served their apprenticeship cannot make a clean job, often a botch; so have a pivot drilled in on a new pinion, but it will require movement for the depth.

Broken Teeth.—By accident (but how often astonishes me; nevertheless it does occur) a tooth or two may be damaged or broken; this work the amateur can manage. You may not have a small vice, but the useful tool, the pin vice (Fig. 2), will hold the wheel as well. This appliance for making new pins costs 1s. 3d. and 1s. 6d., according to size. Place the damaged wheel with teeth injured to front, just clear at the mouth, and proceed with a fine-cut narrow file; cut away the damaged teeth (do not press too hard, or you may break the file), and so cut it dovetail, as at A in Fig. 3. Now take a piece of old broken wheel same size of teeth, etc., if you have such; if not, any watchmaker will oblige you with one, as we have abundance in the trade. Cut it exact size, finish neatly, and fit in; then clean both on the *underside*, being the side which will not show; now solder with blow-pipe and pure solder; do this neatly, without a heavy patch of white on the wheel. File up, and make the best job you can of it by burnishing, etc. Should you be unable to procure a piece of old wheel, take a piece of brass, hammer it well, file smooth, and then fit and solder as above. You will only have two teeth to cut, which, if care is used, will be a neat job. Be sure to burnish new teeth well, so that they run as easy as any of the others. Try the mended wheel with the wheel that runs next to it; if no stop is observable, then all is right.

Broken Chain.—Take it up and examine how neatly it is made; use your eye-glass, see that every other link is double, and then single: the single one is sure to be the one whose eye is broken; so take next single and double link joined, and file the rivet head; then place it upon hammered lead, and with a fine blunted needle tap with hammer until the rivet comes out; do same with the other link. Now you can join the two, single betwixt the double, and with a piece of fine steel wire or a softened needle, put through holes, cut off close, and rivet on smooth piece of steel; trim up neat, and no one can tell where repaired, and the odd link or two minus will be no detriment to the movement. Should a hook be broken, take chain and get a new one right size, then rivet as above. They cost 1d.; cheaper by the dozen, of course.

Bent Teeth, Hands, and Pivots.—Sometimes a tooth or two get bent, so that in trying motion of movement every turn of a certain wheel there is a sort of brake power on. Notice wheel in its revolution: at what part, make a dot with ink; now take out wheel and see it at that place with eye-glass. You will find a tooth or two bent; such is often the case with present make of watches. Not so old verge watches; the wheels in last century were made of metal that had been used for years in smelting fat, etc. So careful were our forefathers that this metal was also well hammered before using it; and then, as you find in old verges, the wheels are firm and good, neither easily bent or broken. The verge is the best made watch; yet, except its escapement, some even have such a preference, they have them converted to levers; and they are worth it if of nice shape, and not damaged by careless usage. Wheels are cast and cut by machinery with such rapidity that it would astonish old watchmakers long since at rest.

To set the teeth perpendicular pass a thin knife blade to the root of adjoining sound tooth, and gently raise the faulty one, and so on with the next, until all are perfect; now replace, and try it; if all runs sweetly, the job is complete.

Bent pivot—not often so, except escape wheel or balance. This is done by carelessly trying to force the watch to go, using anything handy, pin, nail, or pencil, thereby casting balance or escape wheel out of truth; the horizontal is generally the sort injured; the balance has a *wobble;* when in motion take it out, and with the tweezers very carefully raise it to the perpendicular position it ought to have; now try it thus. There is a tool for the purpose, but an amateur need not go to the expense; buy a pair of common compasses, such as schoolboys use, costing 1d. or 2d. per pair; they are soft, so will bend any shape; make them the shape shown in Fig. 4, and at A and B dint or drill a hole slightly at the inside, *exactly* opposite; now place in the cylinder pivots of balance, and just close so as not to press too tight, but sufficient to keep it from dropping out; now at C, to nearly touch the rim of balance, hold a small neat piece of wire, and see, when turning balance around, which part of rim comes nearest; mark that place and take it out, and bend the pivot at that side (under or top as the case may be) from the marked part. Now try it, and if rim nearly touches alike all round, the trouble is removed; replace it in the movement, and it will run even now. Before injury, always remember in bending a pivot to do slightly once or twice instead of too much at once, it will save a breakage and expense.

In the trade we use a small piece of brass with a hole drilled to fit the pivot, and by holding this in small pliers, and raising pivot, no injury is done to the smooth surface, but with care the tweezers will do.

Bent hands you can rectify with the tweezers, and a good eye for straight lines; if it is the seconds hand which may not be level on the barrel part, raise or lower the side as the case may be; this often stops a watch; by touching the dial at one side also causes it to go inaccurately. Sometimes, in fact, nearly always, the pivot is bent upon which the barrel of seconds hand goes; straighten it as previously stated.

Should a pivot hole be worn egg-shape or too large, rind it out a little larger, then procure at the watch material and tool shop ready-prepared bushes, pivot-drilled; fit in, cut off even, and gently tap with small hammer until level and neat; pass the point of fine needle in the bush hole to free it from any irregularity.

Broken Main Spring.—Should the spring be only broken at the outer coil, in or near say to ¾ of an inch of the hole, you can use such spring again; hold the end in small gas flame to temper equal, for say 1 to 1½ in. up it, then punch or drill a hole to fit the pin inside spring barrel; we use a special spring punch in the trade, but an amateur's time is not of that value, and he need not go to the expense; dress up round the damaged end neatly and workmanlike, and fit in as previously described; should it require a new spring by being broke at the inner coil, which is generally the case, take it to the tool shop, and get one same strength, width, etc., and when in the barrel, if it more than half fills it, you will have to take it out; break off the quantity you consider will fit; don't take off too much, or it will not work the thirty hours; so also if too large it has not room to expand; surest way is to notice the old one before removing drill-hole, and fit as above stated.

Some amateurs might desire to go to the expense of a spring winder; it has a nose-piece similar to the centre piece, holding inner coil of spring, called the barrel arbor; this rotates by turning a handle, and so winds up spring small enough to drop into the barrel; when it catches the outer hook it is done quickly, and the spring is not injured as in the other plan.

Broken Square.—To set hands with, take off the dial and dial wheels; pass it out from dial side; being, of course, a horizontal or Swiss lever, the inside centre wheel will not be disturbed; that you must already know, if you have cleaned one; then take old part and movement to procure one same size; it will cost you a mere trifle; press it in, using the small steel washer again; then fix on dial wheels and dial; the minute hand may not quite fit; file end a little or rind the hand; it cannot be far from fitting; refix in case, and the job is complete.

Should a lever watch have too large a swing—in fact, if an American one—it will overturn, being so powerful, and having club-shaped scape teeth, so stop the movement; to remedy, draw the two banking pins a little nearer so that the pallets are not in full play; do not close them too much or you go to the other extreme—just the merest shade; if the swing is greater when movement is in a horizontal position, the ruby pin must touch.

In watch or clock repairing a drill is very useful, and the bow, though old-fashioned, is the best; the archimedean drill is not so good; amateurs can easily fit up a cheap drilling apparatus. Procure a stout piece of wire 15 or 18 in. long, shaped as in Fig. 6, and drill or punch holes at A and B; fix in a first violin string, and fit on handle at C, costing 1d. or 1½d.; bow is complete. Now take a small empty silk reel, plug a piece of hard wood, E, as per sketch, through hole in D, and drive a strong sewing needle, shaped at point as a drill; you may do this neat with your eye-glass; you can fit up three or four various sizes for watches and clocks. For the holder and presser left hand, take a square of wood (hard), 1½ by 3 in., 1 in. thick; dent a small hollow in the middle for E to work in when drilling; now wrap bow-string once round D, and place top square of wood on; gently press while drilling; it is a mistake *to press too hard*—you may break the best of drill-points thus; you will be fit up at a small cost.

Broken Click or Ratchet.—At winding-up part take it out; have a new one, do not tinker with the old one by repointing, etc.; a new one costs so little; it is best plan to get same size, and you can easily fix it on.

Lost dial wheel is a very awkward job, so is a damaged dial, but care will remedy both, even by an amateur. Take off dial and procure a wheel to fit, as all sizes are kept; with patience this can be got over. There are two points to study, this wheel doing double duty.

For a new dial take old one, and from the stock on hand, if you can fit it; it will only cost 1s.; if a new dial specially made, 3s. Notice if centre hole and seconds hole are correct, and outer circumference feet; of course you cannot expect to be right, so drill two holes in plate for them. For appearance to a watch, a new dial is worth cost and trouble; many a good lever looks

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paltry with chipped or cracked dial; new dial in retail shop is 7s. 6d. to 10s. Of course, time in fitting, but charges are heavy. If a silver or gilt dial, being only to fit on surface plate, it is an easier job, as they are only pressed on to old frame; it is hardly worth while regilding or silvering, they never look so well as new, the figures are botchy.

Broken Regulator in Part.—Holding last coil of spring, unscrew the two small screws holding circular part on (but previously take cock off, or you may slip and break balance) at A, Fig. 8, and file top head of broken pin at B, for it will be that which is injured; then draw it out and make a new one; rivet it in at top, having it fixed in small pin vice; sometimes, but very rarely, the index point is broken by someone not fit to handle a watch; if so, get a new one at tool shop to fit cock, very reasonable in price. This completes what I think an amateur is capable of doing.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

111.—NEW PATENT EXTENDING CLOTHES PROP.

THIS is another speciality of Messrs. W. B. Fordham & Sons, Limited, an illustration of which is given in Fig. 1. It consists of two pieces of wood about 6 ft. long, 2 in. wide, and 1 in. thick, one end of one piece being cut into a point so as to enter and hold in the ground when in use, and one end of the other in a notch to receive the clothes line. The two pieces slide one on the other in zinc bends, and may be extended from 6 ft. to any length, by 6 in. up to 11 ft. When drawn out to the desired length the pieces are fixed by means of a peg, which passes through holes bored in each slip, 6 in. apart. The material of which the prop is made is white deal. It occupies but little room, and may be put away in any spare corner. When not in use it may be taken apart and the two slips laid on the back of two chairs, thus making up a handy drying horse. The props are sold at 9s. per dozen.

Fig. 1.—New Extending Clothes Prop.

112.—ECONOMY AND ADVANTAGES OF GAS.

Any one who is interested in the subject of heating and cooking by gas, will do well to send to Messrs. Thomas Fletcher and Co., Thyrma Street, Warrington, for a small pamphlet written by Mr. Fletcher himself, and entitled, "Economy and other Advantages of Gas as a Fuel for General Domestic Use." It proves very clearly the value of gas as a heating medium, and supplies illustrations of all kinds of appliances used in warming, cooking, laundry work of all kinds, and apparatus for coffee roasting at home, heating water for baths, and many appliances used in mechanical arts and trades. Much useful information may be gathered from its pages.

Several of our readers engaged in soldering, who have from time to time inquired for heating apparatuses, might turn their thoughts more towards gas.

THE EDITOR.

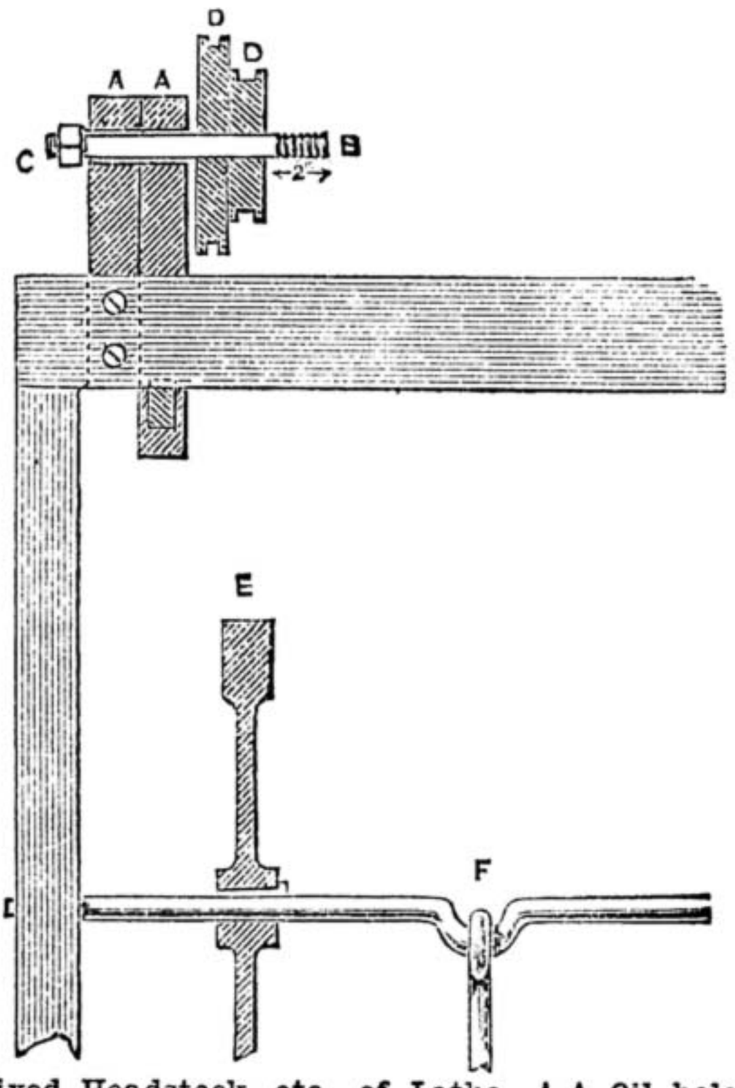
SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** NOTICE TO CORRESPONDENTS.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Lathe Making.—BERNARDO writes:—"I and a friend of mine have constructed a lathe with arrangements very similar to that one previously illustrated and described in WORK. Instead of using a grindstone we use an iron fly-wheel and crank shaft with treadle. The mandrel is of steel with a thread cut on it for 2 in. at right end and 1 in. at the left end. On the mandrel a pulley with two grooves is fixed by driving in wooden keys, flats having first been filed on the mandrel. A nut is placed on the left end of the mandrel. This is the only thing to keep the mandrel in its place. Can you suggest a means of preventing the mandrel moving endways to the right without causing much friction? We put an iron washer between the pulleys and the fixed headstock, but this causes a good deal of friction. The length of brass tube encasing the mandrel and forming its bearing is five inches. Is this too long, for the bearing gets very warm when the lathe has been going for five minutes at 650 revolutions a minute? We drilled two holes from the top of the headstock down to the brass tube, and then drilled a small hole through the brass tube for oiling. Would it be advisable to file a channel in the upper part of the inside of the brass tube so that the oil could flow all along the top of the bearing? Is 650 revolutions per minute a sufficiently high speed? Can you give me any guide for speed for different kinds of wood and metal? Is it advisable to harden the nose of the mandrel (I mean the right-hand end) so that it may cut a thread for itself in a wooden chuck, and if so how must it be hardened, and how must the end of the thread be finished so as best to cut its way into the wood for the chuck? I find the bed screw for the right centre is very awkward to



Fixed Headstock, etc., of Lathe—A A, Oil holes drilled to Mandrel; B, Mandrel; C, Nut; D D, Wood Pulleys fixed on Mandrel; E, Fly Wheel; F, Crank.

get to correspond to the centre of the mandrel, and that if it is correct when just the point is out, when screwed out an inch or so it is wrong again. I suppose I am in fault for not having drilled the hole for the bed screw straight, but I tried several times, having plugged the previous holes with a pin of wood. Could you suggest a simple and cheap easily-constructed centre, where the point itself might slide in a bearing, and be only pushed, not directed, by the screw? These are all the questions I am going to ask you. I expect you will exclaim 'I should just think they were enough.' I hope I shall not have trespassed too much on your valuable time and space, but having had no previous experience at this sort of work, save a little turning on lathes driven from shafting, I am rather at a loss in the above matters."—[To the above questions put by BERNARDO the following reply is given by F. A. M.:—"You and your friend have exercised considerable originality, and, though I must find fault with your arrangement, do not on that account be discouraged, since you may learn more from a mistake sometimes than from a success. You have taken your ideas chiefly from the lathe described on page 261, which is called a 'dead-centre' lathe, because both centres are still, or 'dead,' whilst the work revolves upon and between those centres. Now the dead-centre lathe is by far the easiest of construction, and it is very good for one kind of work, viz., that kind which is turned between centres, such as tool handles, spindles, as of watches, little shafts, etc., but you have evidently perceived that it is unsuitable for what is called 'chuck work'—that is, hollow and other work turned without the support of the backcentre; *en l'air*, as the French turners call it, because it turns in the air with no support but the chuck which holds it. Therefore, instead of bringing the mandrel to a point, fixing it firmly in the head, and allowing the pulley to turn upon it, as advised by SELF-HELPER, you have screwed the end of the mandrel, fixed the pulley upon it, bushed the headstock with brass, and arranged a kind of running centre, or ordinary lathe, of bad form. Having gone so far, you should have gone further still by separating the two blocks of which your headstock is made, and fitting the pulley between them, to avoid the unnecessary overhang of your nose-screw. No wonder your mandrel moves endways. You want a turned collar between the pulley (as you have it) and the brass bush, then at the other end a second nut to lock with the other, and between these and the back end of the bush a washer fitted on a feather so as to turn with the mandrel. I would cut away all the middle part of your 5 in. length of bush, and have only 1 in. at each end. I fear, however, it will be difficult for you to make a good job this way. It would have been easier to make a back-centre headstock. You are 'falling between two stools,' as the saying is. 650 revolutions per minute is fast enough for large work in wood, but rather slow for chessmen, handles, etc. The speed must be reckoned according to the diameter of the work. Have mandrel pulley $\frac{1}{3}$ or $\frac{1}{5}$ the diameter of largest speed on fly-wheel for wood turning. Speeds for turning a 1 in. bar in brass, 150 revolutions; cast-iron, 140; wrought iron, 130; steel, 70. You ask whether it would be a good plan to harden the mandrel nose and form it like a tap so that it might cut its way into wood chucks. Rather startling! Still, if the nose were quite small, say, half an inch diameter, it might be possible, especially if you make it 2 in. long. The usual length would be $\frac{5}{8}$ in. However, you might try it 1 in. long with that object, and file 3 deep grooves in the end with a round file, the grooves to extend $\frac{3}{4}$ in. so as to leave $\frac{1}{4}$ in. of full threads; then harden only the end, as far as the grooves extend. When fitting a chuck, stop when it is screwed up as far as the grooves on the nose, and use a narrow chisel to true up that part of the chuck which comes up against the shoulder of the nose-screw. You seem to have no shoulder to screw the chucks up to. This shoulder is essential; it is called the face of the mandrel, and the part of the chuck which comes up to it the face of the chuck. As to the alignment of the headstocks read my paper on 'How to Test a Lathe' on page 50."—F. A. M.]

Purchasing Timber.—A. R. (*Scorrier Saw Mills*) writes:—"I was pleased with some remarks in No. 33, page 522, of WORK, by A. J. H. on the purchasing of timber. I hope A. J. H. will excuse me for correcting an error made in reference to 3 in. deals. A. J. H. said if you want 12 ft. 1 in. by 9 in., ask for 12 ft. 3 in. by 9 in. with 2 equal cuts. Deals are generally cut in deal frame, the saws wasting from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. full. This means in 2 cuts $\frac{1}{4}$ in. full waste of timber, therefore each plank or board would be but $\frac{1}{8}$ in. full, and 5 cuts in a 3 in. deal. Instead of there being six $\frac{1}{8}$ in. plank there would be six $\frac{1}{8}$ in. full. Often tradesmen come into the yard, and want four $\frac{1}{4}$ in. boards from a 3 in. deal. It's absurd. If it was possible to cut the deal with saws not stouter than a cobweb, there would be some waste. Such men, I think, leave their thinking caps at home—that is, if they have any to leave."

Folding Stove and Oven.—DEALER (*Leeds*) writes:—"As a common-sense reader, I wish to make a few remarks in reference to Mr. James Scott's folding combined cooking stove and oven. I certainly agree with the construction and dimensions of it, but my experience leads me to think it would be better made of light sheet iron and done over with Brunswick black or some other preparation, instead of made of tin, as the heat would disfigure its appearance, especially if it is to be carried about as Mr. Scott says. And, as for the brackets, I should think they would be much better riveted on instead of soldered on, because where there is heat enough to cook anything there is heat enough to melt the solder off, and they would be an everlasting trouble."

Brazing Band Saw.—A. X. E. (*Nottingham*) writes in reply to G. (*Salop*), page 396, No. 25:—"I may say I braze about four or five a week on an average with a machine by Duncan & Mills, of Oldham, who deal in a variety of setting and sharpening machines for band saws, etc. I have used it for about two months now, and never had one bad joint. Mr. Duncan himself taught me how to use it; he travels with the machines and teaches all purchasers. The price of a brazing machine I may say is under 30s., and I can braze one joint in half an hour, more or less."

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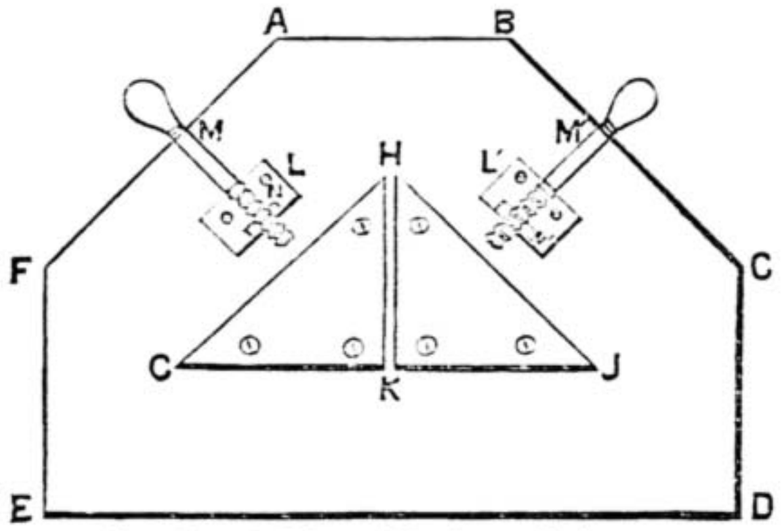
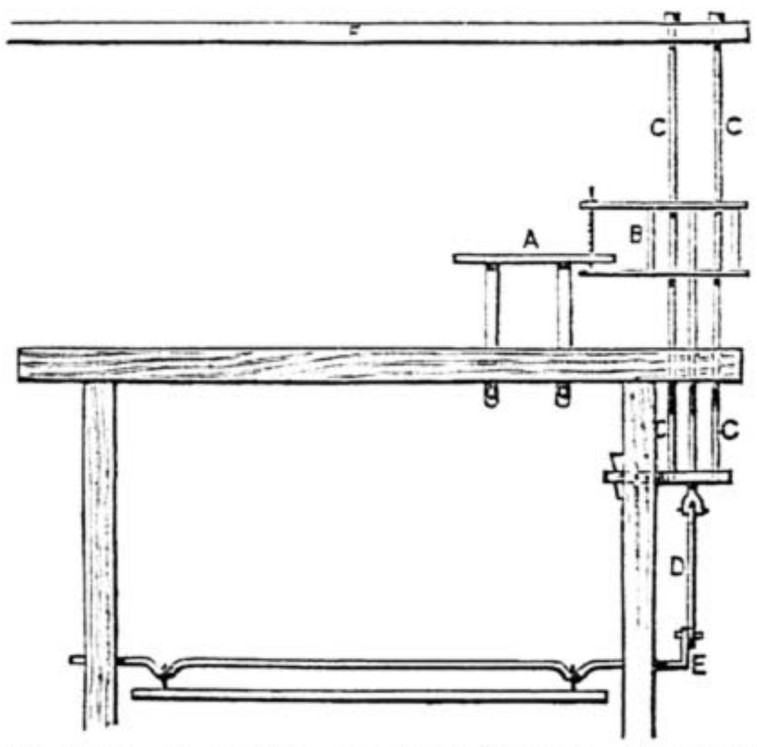
Combined Mitre Block and Corner Cramp.—KILDONAN writes:—"The following makes no pretence of being anything else than a 'means to an end,' and experienced craftsmen are respectfully requested to shut their eyes if they are inclined to be critical. Having some pictures to frame, and having neither a vice nor corner cramp to aid me, I hit upon the expedient now humbly offered. By its help I have



Combined Mitre Block and Cramp.

been enabled to mitre my corners perfectly, and the most expensive and complicated tool can do no more. A B C D E F is a piece of well-seasoned beech or other hard wood, about 1 in. thick. This forms the base of the block. G H J is a triangular piece of similar hard wood screwed firmly to the base by stout screws. The angle, G H J, is a perfect right angle. H K is a saw kerf perpendicular to G J, and bisecting the angle, G H J. It is evident that a piece of moulding laid along H G, while the saw runs in the kerf, H K, will make a perfect joint with another piece laid along H J, and sawn in the same way. Getting hold of two half-inch bolts, M and M', with nuts an inch square, while the length of the screw thread just allowed an inch of play, I sunk the nuts, N and N', into the two short pieces of hard wood, L and L', through which holes are bored to allow the bolts through. L and L' are then firmly attached to the base at a convenient distance from and perfectly parallel to the sides of the block, H G and H J. The diagram is not drawn to scale. Every man can suit the dimensions to his means and requirements. My own block is not even planed, the essential points being accuracy in the angles and edges. If, as in my case, the screws are short, and narrow mouldings to be joined, blocks of wood can be placed between them and the screws. Having applied the glue, bring the corners carefully together, screw up tight, drive in a nail at each side, and your corner is complete."

Fret Saw.—A. A. (*Coventry*) writes:—"It appears to me that ARTIST IN WOOD and W. R. S. have taken great pains to give us methods of fitting up saws for fret cutting that will not work. For instance, what gives the up stroke in ARTIST IN WOOD'S saw, and how does W. R. S. get over the throw of his crank? I enclose a sketch of one that

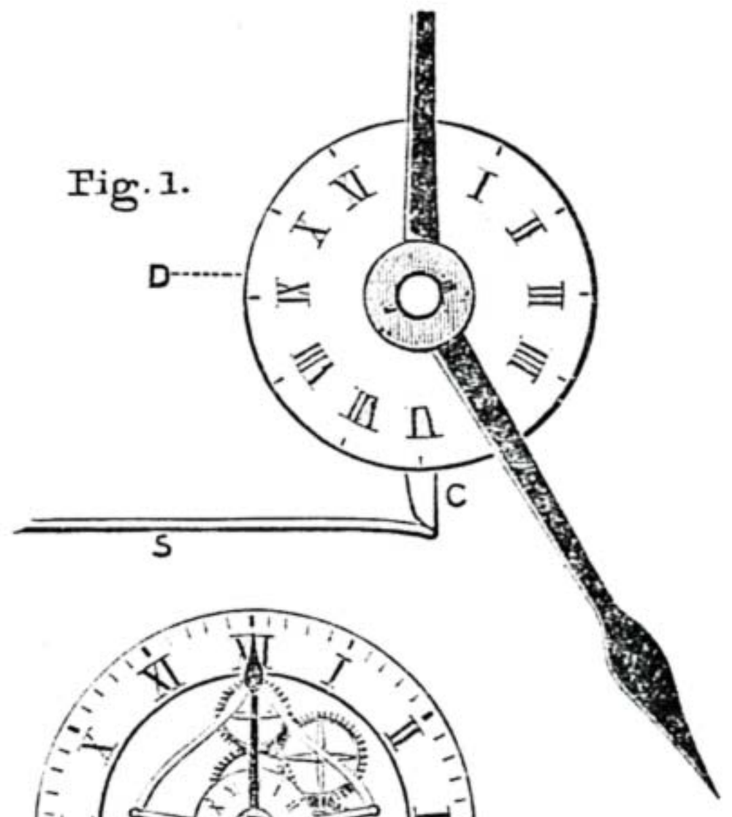


Fret Saw—A, Table: B, Saw Frame; C, Guide Rods; D, Piston Rod; E, Crank; F, Beam.

will work, and work well too. It is entirely home-made, the guide rods being old brass bedstead tubing, the piston the rod of a beer engine pump. The saw I made out of a watch spring. The frame of the saw is ¾ in. ash, and the piece at the bottom of guide rods to steady the piston is ash also, firmly mortised into the upright and wedged. When the saw is not in use I unscrew the top of D, and push the saw up to the beam out of the way. It has a stroke of ten inches."

Electric Time Alarum.—J. W. O. (*Paddington*) writes:—"Having seen in WORK No. 32, page 497, Mr. Bonney's description of how to make an electric time alarum, I have taken the liberty to write to you and try to explain how I have made one for myself, which I have had in use for this last six months, and it has never failed. The clock is one in which the works are visible in a wood case. First of all, I cut a small circular disc of brass one inch in diameter, except at one part. I have left a small piece protruding barely ¼ inch long, so as to make a connection with a small brass spring. On this disc I have marked the hours the same as you often see on an alarum clock, with six o'clock exactly over the little catch. I have drilled a hole through the centre of this disc, and fastened it on to the back of the hour hand firmly, but so that I can easily turn it round to any time I wish. To set it I turn the disc round till the hour I want is opposite the hour hand. The spring is made of a narrow thin strip of brass. This I have fixed to the inside of the case and bent it out, taking care it does not touch the metal work of the clock, but so that the end (which is slightly bent downward to allow of the catch rising on it easily) is exactly under six o'clock, and will press

Fig. 1.



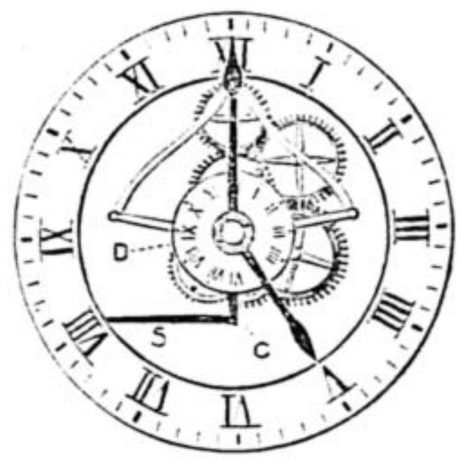


Fig. 2.

Electric Time Alarum. Fig. 1.—D, is the Disc full size; S, the Spring; C, the Catch. Fig. 2.—Disc fitted on Clock.

gently against the catch when it comes round, so as to connect the current, but so that the catch can pass easily over it without stopping the hands. It is about 35 to 40 minutes passing over (quite long enough to wake anybody). I have brought the wire which is connected to the works and the other from the spring inside the case to two small metal plates let into the bottom of the case at the back, and these stand on two similar ones with a slight spring in them, to which the line wires are attached. These last two are fixed on the mantelpiece, so that the clock can be shifted at any time without having to disconnect any wires or disfiguring the case with terminals, etc. It is joined up to the bell, which I made myself, with a switch; so all I have to do is to switch it on or off. I have drawn a rough sketch of the disc and the clock face to show how it is fixed. I mostly employ my spare time of an evening in this way. I have taken in WORK from the beginning, and have found it very useful, and I wish it every success. I hope I have not encroached too much on your valuable time and space."

Jewel Case Tools.—C. T. (*Edinburgh*).—The best place for you to go for the tools you require is Buck's, Tottenham Court Road, London.—G. R.

Violin Making.—VIOL (*Cork*) writes:—"I complain that you are keeping the fiddle-makers a long time in suspense. We expected the violin article sooner."—[The articles cannot appear until the second volume of WORK.—ED.]

Dulcimer Instruction.—J. McF. (*Edinburgh*) writes:—"I am glad to see a little more about how to make a dulcimer. I may say I have one, but I cannot make a start to play it. May I ask R. F. if there is an instructor for the dulcimer? If not, could R. F. or ALPHA tell me where I could get a few tunes marked out, which I would gladly pay for?"

Levelling Oilstones.—W. H. D. (*Birmingham*) writes:—"Your issue of October 9th gives a description of a board prepared with emery for levelling oilstones. The method is no doubt an effective one, but I think it would not find much favour with amateurs owing to the trouble of making the board. The plan I have had in use for a number of years is as follows:—Get a sheet of coarse emery cloth, say 2½ in. size, which may be bought at an ironmonger's for one penny; tack it to a flat board by the four corners, or it may be glued to the board. You have then a board ready for use quite as good as the board mentioned above. A few minutes' rubbing will soon show its effect on an uneven oilstone."

Dresser, Perambulator, and Mirror.—H. G. (*Bishopsgate*) writes:—"I notice in WORK that you take an interest in those who persevere, so I thought I would send you some rough sketches of what I have made as an amateur. By trade I am a bootmaker. Fig. 1 is a dresser which holds a tea-service of 48 pieces. I made this of deal, with the aid of a keyhole saw, an iron chisel, and a shoemaker's knife. The spindles are of mahogany. I then stained it and polished it. I have been

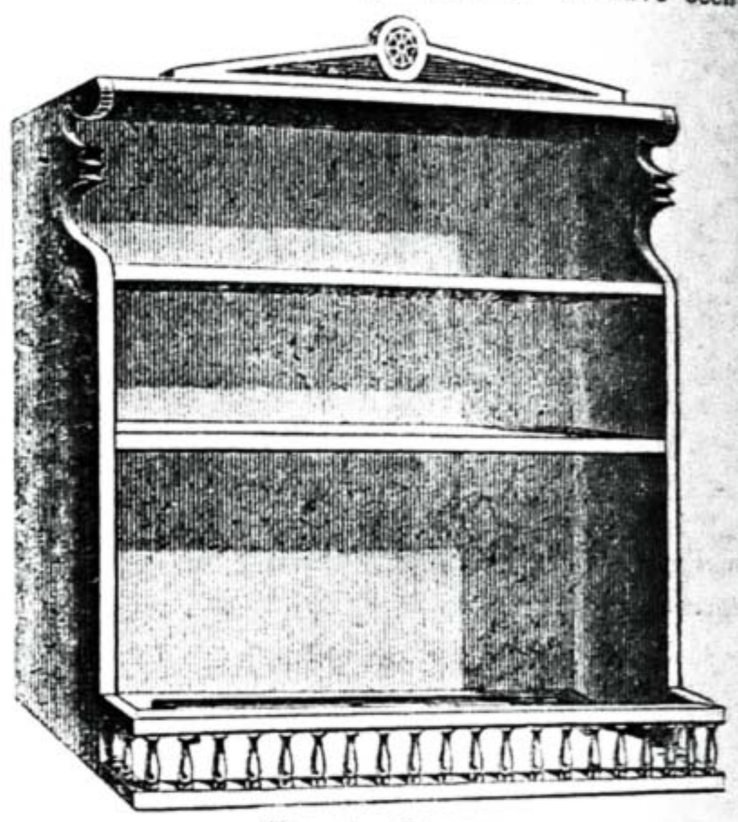


Fig. 1.—Dresser.

offered 20s. for it. Fig. 2 is a clockwork perambulator. The wheels, which are iron, and 5 in. in diameter, I bought, made the carriage, enamelled it black, and lined it red. The handles are made

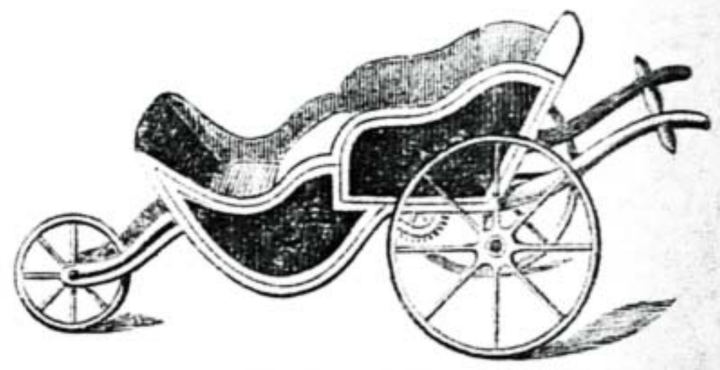


Fig. 2.—Clockwork Perambulator.

for a doll to run behind it. Fig. 3 is one of a pair of mirrors covered in red plush, with a gilt frame 12 in. by 14 in. I am also pleased to inform you that I have made a deal table with flaps, turned legs, and casters, which is 56 in. long and 51 in. wide, and as solid as a rock. I have also a linnet's cage which I made of mahogany. If I want a waistcoat, I purchase the cloth and make it myself: or a suit of clothes for my little boys, I make it myself. Now

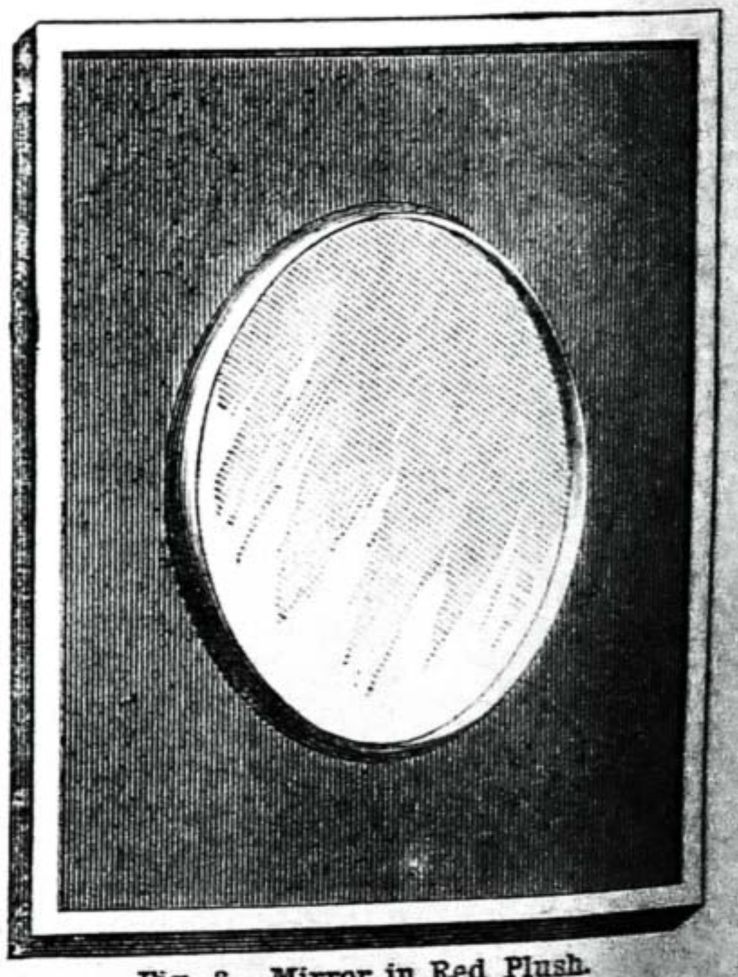


Fig. 3.—Mirror in Red Plush.

I am waiting to see the design of the bookcase which you gave a prize for, so as I can make it myself. I have never worked at any of these trades; they are all my first attempts, and they have turned out successful, and if you can find space in your journal for this letter, I think it will encourage your readers to try to do likewise. It often puts a shilling or two in my pocket when my own trade is slack."

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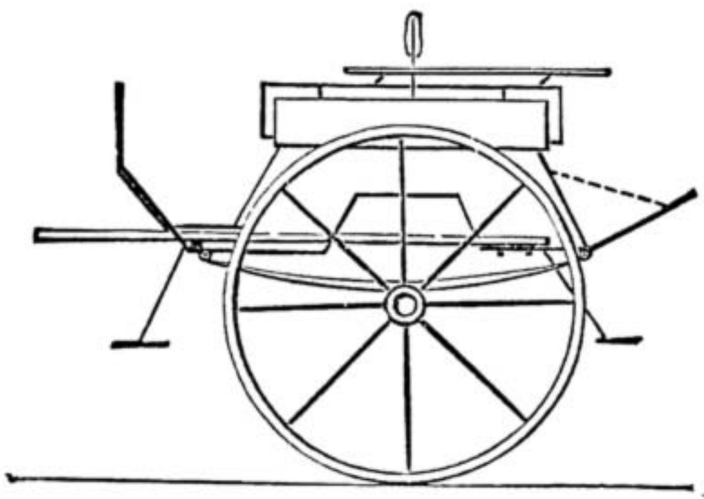
II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Engraving Door Plates.—X. L. S. R. (*Falkirk*).—I should advise you, before you commence seriously to try and engrave, to wait until some papers on the subject make their appearance, which I trust will be shortly. To help you meanwhile I give you a short sketch of the method used. First, of course, you must prepare your metal, This is done by filing the surface off the brass, then using pumice stone to remove the file marks, and finishing with emery cloth. You then have your plate ready for work. The tools you must use are chisels specially made for the purpose, which can be had at Buck's, in Tottenham Court Road, or any other tool warehouse. You must sharpen the end of your chisel just as you would your knife, and then rub the face until it is the shape of a diamond. We should advise you to get an engraver to show you his tools; you would then understand the setting of them better than by any description we could give. Next draw your name on the brass with a steel point. We should advise you to commence with block letters, these being easier to engrave. You must then outline your letters with your graver, being careful not to use your hammer too hard, or you will cut too deep. When you have engraved the outline, next cut out with a broad chisel sold for the purpose, and touch up the letters with a hand graver. To wax in, heat the brass from underneath, and put the wax on till you have covered the letters, being careful it does not boil. You must then pumice off the wax, and polish your brass by using fine emery, rotten stone, and oil. I cannot tell you more in the space at my disposal, but will answer any questions you like to ask on the subject.

Gilding on Satin.—T. P. (*Redditch*).—I must own that unless it were possible to see the kind of articles your inquiry refers to, it is hardly safe to offer you very definite instructions both for hand and press. I have, however, gilded monograms and so forth upon morocco leather, fancy cases, etc., so that the subjoined may be of assistance to you. Draw the design upon a thin piece of white paper, then carefully prick through the lines with a pin, and pounce the design through with chalk, if upon dark surface, or with finely-powdered charcoal if upon light, the powder being contained in a little muslin bag, the texture of which, when tapped over the design, will allow the contents escaping through the pinholes, marking the pattern upon the article. Care must be taken that the pounce—that is, the pricked drawing—does not shift in the least. If you wish to paint or gild upon silk or satin the same directions will suit; but, of course, the fabric would have to be evenly extended upon a flat surface, or by some kind of stretching frame. Having successfully transmitted the design to the article we must make the surface non-absorbent before gilding upon it. Procure either japanners' gold size or quick-drying varnish—that made specially for baths—and rub up finely with a palette knife, a little dry middle chrome, and mix it thoroughly with the vehicle used. Now, with a fine sable pencil carefully paint in the design, if necessary using a few drops of turpentine with it to enable you to work it the better. It is not advisable to use much chrome, only sufficient to well stain the varnish or size so that we can see nicely where we are going with the brush. When thoroughly dry we can pencil on the gold size which is to hold the gold leaf. You can either use japanners' gold size or gilders' oil gold size. The first is cheapest and quickest; the latter has more burnish, and is more durable. In either case add a very little of lemon chrome, so that we see that nothing is missed, and paint it on in the same manner as before, but only a bare coat. If japanners' is used it will be ready for gilding in about half an hour; if oil size, the work is sized one day and gilded the next. In pencilling on the gold size keep just within the edge, if possible, of the first coating. Use English beat gold leaf, about 1s. 3d. per book. If you are not able to use the tip and cushion, let the leaf of gold drop gently on to the size, slightly press it down with cotton wool, and after standing for a little time give a final gentle rub to burnish it, and clean off the superfluous gold. If I had a quantity of small fancy articles to gild—leather or satin—I should draw the design on thick note paper, cut out a stencil of it with a very fine and sharp penknife upon glass, and thus stencil the pattern on, if necessary putting in any fine strokes with a sable pencil afterwards. All this you will see requires a little art and much careful and practised manipulation. I hope you may find this useful to you.—F. P.

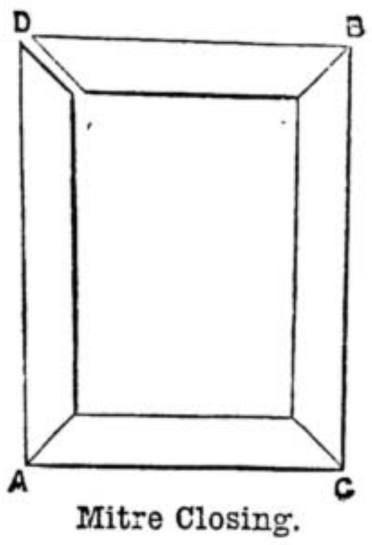
Village Cart, Dimensions.—AN AMATEUR.—The name "village cart" is applied to vehicles of various patterns, but I assume that the one you require is something like the annexed sketch; also that you require a medium, or "cob" size, as your description, "a cart for four persons," might apply to a vehicle for a small pony, or to one for a large horse. The directions for building a Battlesden Cart, No. 19, page 295, will serve for a vehicle of this pattern with a little adaptation. The supplementary sides are rectangular, and are set perpendicularly to the sides, instead of being "pitched," as in the Battlesden. The front foot-board is also different, being much deeper, and attached by two strong stays running the full depth of foot-board, and under the body about 18 in. The length of sides at top should be about 3 ft., and at bottom 5 ft., their greatest depth being 16 in. The bottom should be about 28 in. wide inside measurement. The sides to be pitched at an angle of about 97 degrees with bottom, which, with the same arrangement for supplementing the seatage, as in Battlesden, will give ample width at top. The supplementary sides to be about 9 in. deep



Sketch of Side Elevation of Village Cart on ¼ in. scale.

by 3 ft. 4 in. long. Two straight springs 4 ft. long, 1½ in. wide, with 5 plates, will, I think, be sufficiently strong for this trap. The shafts should be 6 ft. in front of the transom, and sufficiently long to run back almost the full length of the body, as in Battlesden.—OPIFEX.

Mitre Cutting.—AMATEUR.—Mouldings are usually of a long length, and not moved in machine with such ease. It is well to cut them at required lengths first, and then trim with the machine, being careful to sight them up exact—that is, place sight edge (or that which is nearest picture when framed) to edge, and see that they are both of an exact length, long and short sides. The machine has regulating screws to get the exact pitch of 45°, or it is as well to join the short sides to the long at A and B, and let them set. Then, in the third joint at C, you can see if it requires a little off. When the third joint is made, the fourth, at D, should meet within ¼ in. It will then close in making the last joint, as shown in accompanying diagram.—G. R.



Mitre Closing.

Removing Old Paint.—THREE LEGS.—Glad to learn you find WORK so useful, and hope this may further assist you. By the way, if you find it difficult to get your weekly issue, why not subscribe direct—three months for 1s. 8d., including postage. The article you mention is one of the ordinary house-painter's charcoal-burners. Respecting the lime and soda method, this process, especially for wood that was required to be stained afterwards and not painted, would have been undoubtedly the best. As to the mess, house-painting isn't usually the cleanest of work for one's hands; but with ordinary care to prevent the hands getting burned there is nothing very unpleasant about the task of removing paint. If the woodwork has mouldings on it, the lime is by far the best, since with the burner the most prominent parts would get burned before the heat could perish the whole of the paint on more recessed portions. If you have any more to treat, mind you get fresh dry lime, use plenty of soda, and put the mixture on with a palette, or broad knife, in the form of a paste; after standing a few hours it should then easily scrape off clean to the wood. Well wash the woodwork with cold water, and when dry, coat it with vinegar, using a brush as in painting. The vinegar is to kill the chemical action of any of the resolvent that may be still left in the grain of the wood, and which would otherwise perish the new paint, etc., put upon it. The usual difference in the appearance of the burnt-off work is that some of the priming remains in the grain of the wood, and therefore the surface would not be so absorbent as the lime treated portion, and you would find yourself unable to get a uniform colour. I rather advise painting and graining (plain-combing) in your case, but if you must have stain, try the following:—Rub it all down with glasspaper, and coat the lime-burnt portion with vinegar; when dry give it all a good coat of warm glue, or patent size; this will make all the surface non-absorbent. Purchase some ordinary oak varnish (remembering the price should govern quality); or, better still, that known as "hard-drying," or "church oak," also some turpentine and a few pennyworth of burnt umber in oil. Take equal parts of varnish and turps, mix and stain with umber to desired colour; if you want a more yellow colour use raw sienna for staining; strain before using, and spread carefully and evenly, brushing it the way of the grain. When dry, finish with one or two coats of varnish, or you may give it two coats of stain. Water stain is out of the question under the circumstances of the two surfaces; but were it cleaned right off to the wood by lime, etc., then after vinegaring, you can stain with water stain, and after this two coats of size and one of varnish. Any paint brush, as large as suits the size of your surfaces, will do, providing that it is quite free from dust or paint, and that the hairs don't come out in using. The darker the stain the better the job in your case, I feel sure. —F. P.

Angular Advance of Eccentric.—W. R. W. (*Blaenavon*).—You can work the position out geometrically, or determine it by the following formula:—

Let $a°$ = angular lead of eccentric.
d = distance in inches passed over by valve when piston is at top of stroke.
t = travel of valve in inches.

Then

$$\text{Cosine } a° = 1 - \frac{2d}{t}$$

To use this find the value of $1 - \frac{2d}{t}$ and look out the result in a table of cosines; the angle opposite it will be that required.—F. C.

Water-Wheels.—SCRUTINEER (*Bolton*).—You may find the horse power (h.p.) of water-wheels from the following rules:—

Undershot Wheel.

Let V = velocity of water in feet per second before acting on wheel.
V = velocity of water in feet per second after acting on wheel.
Q = quantity of water in pounds per minute passing wheel.

(Note.—One cubic foot of water weighs 62·3 lbs.)

$$\text{H.P.} = \frac{Q}{6{,}440{,}000}\left\{V^2 - v^2\right\} \text{ for radial floats and}$$

$$\text{H.P.} = \frac{Q}{4{,}000{,}000}\left\{V^2 - v^2\right\} \text{ for curved floats}$$

Overshot Water Wheels.

Let h = height in feet of water in pen-trough above that in tail race.

$$\text{H.P.} = \frac{Q.h}{55{,}000}$$

Breast or pitch-back wheels.

$$\text{H.P.} = \frac{Q.h}{44{,}000}$$

Turbines.

$$\text{H.P.} = \frac{Q.h}{50{,}000}$$

F. C.

Bronzing Ferrules.—ANGLER.—To bronze ferrules, reels, etc., for fishing rods, the brass should be turned smooth and bright. The best results cannot be obtained without a lathe finish. The parts must be perfectly free from taint or grease, so should not be handled. Use fine emery cloth and a good speed, and hold the work when finished with a perfectly clean piece of old linen, etc. To make the bronzing mixture, take some new iron filings—about as much as will fit on a shilling—1 oz. of hydrochloric acid (spirits of salts) and ½ drachm of arsenic. Pour the acid upon the iron filings in an earthenware vessel or glass, and let it stand for half an hour. Dissolve the arsenic in a tablespoonful of strong vinegar, and mix with the acid and iron. Strain the mixture through a piece of linen, and bottle for use. As a little of this liquid goes a long way, the above quantity will be sufficient for a good many articles. Now heat the brass moderately by holding it over the flame of a spirit lamp, or better, let the flame play upon the metal while running in the lathe, and while hot apply the bronzing mixture. The best way to do this is to make a small pad of clean rag, and tie it on the end of a piece of wood, wet the pad in the mixture, and hold it to the work as it revolves. The colour will immediately appear, and the pad should be applied until the desired shade is obtained. When sufficiently dark, hold a piece of dry rag to the work until it assumes a good polish, when it may be removed from the lathe and is ready for lacquering. Procure some pale gold lacquer and a flat camel-hair brush, heat the work slightly, dip the brush in the lacquer, and remove excess by drawing the brush across the edge of the cup, etc. Give an even coat, avoiding passing the brush over the same place twice. When dry, again heat, give another coat of lacquer, and hold near a hot fire, or place in a moderately hot oven for a few minutes, and then lay aside till cold. During the process of lacquering the fingers must not touch the surface to be lacquered, but when finished and cold the work may be handled freely. Should a lathe not be available, clean and polish the work with fine emery cloth, dip in a strong solution of pearl ash or washing soda, rinse well in clean hot water, and when dry dip the work in a mixture of strong nitric acid, 2 parts, sulphuric acid, 1 part, to which add a pinch of common salt. Dip for two seconds, and then rinse well in a pailful of clean cold water. If at all cloudy, dip again as quickly as possible, and again rinse. Dry the work in hot boxwood or beech sawdust, and then apply the bronzing mixture with a brush, from which point the operations are the same as in the first process.—OPIFEX.

School for Practical Electricity.—DESIRE (*Peckham*).—The City and Guilds of London Institute has opened an evening department at the Technical College, Finsbury, for instruction in mechanical and electrical engineering, technical chemistry, applied art, etc. The session commenced on September 30th, and the fees range from 6s. to 30s. for the session, inclusive of charges for use of laboratories and workshops. For further particulars apply at the College, Leonard Street, City Road, E.C..—G. E. B.

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French Polishing.—J. P. (*Hackney*). — There are one or two books on French polishing, but they are better adapted to professional than to amateur polishers, and I think you will derive at least as much information from reading the hints given in these columns as from any book I know of. You see in "Shop" the little difficulties which beset an amateur are brought forward week by week, and many of them are such as could hardly be anticipated by any one writing a treatise, although they can be explained and errors pointed out. Thus the mistake you have made seems to be that you have used the same rubber for both bodying and the final spiriting off. Try a fresh one for the latter, with a very little spirit, without polish or oil. Use a few, say, four or five, layers of the covering rag between the wood and the moistened wadding. As the outer one dries, remove it, and so on with each in turn till you get a smooth and permanently brilliant surface. Of course you can hardly expect to get this without practice, but by attention you will no doubt see a marked improvement by degrees. Never be afraid to tell us of your difficulties in any description of work, and describe your procedure fully. You may be assured that if one member of the staff cannot assist you another will.—D. A.

Nominal Horse-Power. — SCRUTINEER (*Bolton*).—In these days nominal horse-power is a very uncertain and unsatisfactory expression, as there is no fixed rule about it; in the English Admiralty it is dropped altogether. Formerly when engines ran at low pressures and fixed speeds, the term was commercially convenient. In the Mercantile Marine the rule is very uncertain, most makers having their own, and all of them being arbitrary. Before the introduction of compound engines and high boiler pressure, it was a common rule to allow 30 circular inches of piston area per N.H.P.:—

$$\text{N.H.P.} = \frac{(\text{Diameter of piston in inches})^2}{30}$$

After that period, for compound engines where D = diameter in inches of low-pressure piston and d = diameter in the same of high pressure piston—

$$\text{N.H.P.} = \frac{D^2 + d^2}{33}$$

Neither of these rules takes any account of length of stroke or boiler pressure. To allow for the latter some makers reduced the divisor from 33 to 30, as the steam pressure was increased from 60 to 80 lbs. per square inch. For high-pressure engines the following rule has been used: let D = diameter of cylinder in inches, and S = stroke in feet:—

$$\text{N.H.P.} = \frac{D^2 \times \sqrt[3]{S}}{20}$$

For your first example, compound engine, cylinders 24 in. and 38 in. diameter

$$\text{N.H.P.} = \frac{D^2 \times d^2}{33} = \frac{1444 \times 576}{33} = 61{\cdot}2\text{—N.H.P.}$$

2nd, Condensing engine, cylinder 15 in. diameter—

$$\text{N.H.P.} = \frac{D^2}{30} = \frac{225}{30} = 7{\cdot}5\ \text{N.H.P.}$$

3rd, High pressure engine, cylinder 18 in. diameter, stroke 1 ft.

$$\text{N.H.P.} = \frac{D^2 \times \sqrt[3]{S}}{20} = \frac{324 \times 1{\cdot}581}{20} = 25{\cdot}59\ \text{N.H.P.}$$

F. C.

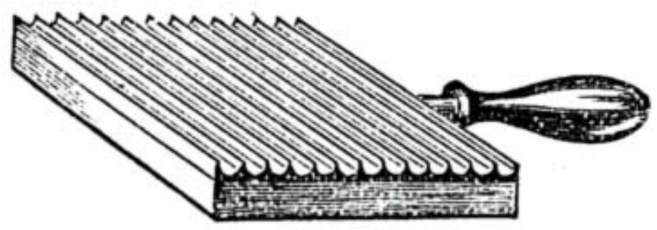
Materials for Oak Graining.—J. H. G. (*Bridgwater*). — The processes and materials used in all kinds of imitations of wood will duly be described later on. As you understand "plain painting thoroughly"—which I am pleased to know—it will only be necessary for me to give you a general idea of the ingredients used in mixing graining colour, so that you can adapt them to your particular requirements. Whether light or dark oak is desired, the colour of the ground, that is, the last coat of oil paint, must be in tone with the graining colour; if the former is made a decided yellow cast the latter should be of a rich or golden shade, and not too hard a contrast of shade between the two. There are many different methods of mixing graining colour for producing the best class of work, but for ordinary work the subjoined will do. Graining colour should always be clean and semi-transparent, easily used with the ordinary paint brushes, so that one can first spread a fair quantity, and then be able to manipulate it with combs, etc., before it commences to set. Procure two ounces of patent or liquid driers; add equal quantities of raw linseed oil and turpentine, up to nearly one pound; thoroughly mix, and then stain to the desired colour by adding ochre and burnt Turkey umber ground in oil. For medium oak, burnt umber alone gives a rich, transparent colour, whilst some grainers will substitute raw sienna (Terra-di-Sienna) for the ochre. Raw umber alone makes a good stainer for very light oak, and very rich tones—seldom advisable or necessary, however—can be obtained by introducing a little burnt sienna. I recommend mixing the liquids and driers together first, and afterwards staining to the desired colour for two reasons. We can judge how much we want for our purpose, and thus prevent waste, whilst the plan of staining the mixture and trying it until satisfactory, gives us thorough control over the colour and shade. The average painter will take a quantity of umber, driers, and usual liquids, and knock it up together with the usual result of having to thin it down to double the quantity before it works freely, and is right in colour, thus having a lot left, and probably wasted. The proportions given make a graining colour which will stand, if necessary, for about two hours before being combed, and should then dry in about eight hours (indoors). If desired to set and dry more quickly, use more turps, and, of course, driers. It should be about the consistency of thin soup, and be strained through muslin before use. I should think you could get graining combs in Bridgwater at any dealer in painters' goods; if not, there are plenty of shops in Bristol. If preferring to obtain through the post, write to Pavitt & Sons, 70, Southampton Row, London; or to Crowden & Garrod, 62, Southwark Street, London, S.E. Steel graining combs are sold in various widths—from 1 in. to 3 in.—and degrees of fine and coarse vein; they are usually retailed at 1½d. per inch and 2s. 6d. per set of twelve in tin case. I wish you every success, and also advise you to look out for the articles now being written on your subject.—F. P.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Flour Paste Souring.—DILETTANTE (*Glasgow*) writes in reply to J. R. (*Skerries*) (see page 398):—"Though rather late I will give him a recipe which I am sure he will value. I have seen many paragraphs on paste in your paper, but have never noticed the preservative I use mentioned. The substance is corrosive sublimate; 15 grains to a pint of paste is, I think, the proportion. Mode of use, crush to powder and dissolve in a little hot water; then pour paste over it from your pot or saucepan, stirring briskly to mix well. Of course, corrosive sublimate is a deadly poison, and is difficult to procure, but it is worth the trouble. As to danger, I have used paste so prepared for years, and never had a mishap, though I always apply it with my fingers. This should not be done if any cuts are about the hands. I believe my paste would keep good for years—certainly till it is far too hard to use."

Wheels.—R. B. (*Largoward*) writes in reply to G. W. (*Bournemouth*) (see page 332):—"You say that machine-made materials for wheels can be bought almost as cheap as in the rough. Will you kindly give address where material can be had?"

Pill Making.—B. C. D. (*Kilburn*) writes in reply to J. C. (*Carlisle*) (see No. 31 of WORK, page 494):—"I don't know much about the subject, but I saw a man making pills about a dozen years ago. The apparatus that he used was very simple. It was made of two pieces of wood about 6 inches square and 1 inch thick, with a piece of brass let into one face of each piece. The brass was scooped out in a series of semi-circular grooves. Each tool was provided with a handle, as shown in the sketch, which



Pill-Making Machine.

represents one of the tools. The way he used the tools was to first flatten out the paste, and then put it between the brass faces so that the grooves came just opposite each other; then press both tools together so as to cut the paste into a series of round bars; the bars were then taken out and put across the grooves, and the process repeated so as to cut the bars into little bits; then they were worked about between the tools till they were made as round as was possible."

A Cutting Drift.

Drilling Square Holes.—The Britannia Company (*Colchester*) writes (see page 270):—"It is one of those ideas which some may think of value, but it is much easier and quicker to drill a round hole and then drive a drift into it, to cut it square, than to drill a square hole. Some unfortunate inventor patented the above mentioned appliance, and, like many a hundred other victims of the inventive faculty, found only the honour of being a patentee to result from it."

Spirit Level.—G. M. (*Sheffield*) writes in reply to D. J. (*Oldham*) (see page 510):—"If the slot you mention is in the wood, you will require a 4-in. tube ⅜ in. thick; although called 4 in., the length, with the nipple at each end, is nearly 4½ in. You fix it as follows:—Fix a board quite level, place your level on it, put some putty or plaster in the slot, and press the tube in. Then screw on the top piece of brass, taking care not to shift the tube; if it does move you may press the high end down a little."

An Easily-Made Fret Machine. — W. R. S. writes in reply to W. W. M., BLOCKHEAD, G. P., NEMO, and A. H. H. (see page 508):—"The wheel is fastened to the axle in the ordinary way, and made to revolve in either direction. The connection of the treadle to the wheel is the same as that of an ordinary sewing machine, except that the bottom part of C is also fastened by a bolt to the wheel; the top part is only fastened to the pipe A. The size of the table is immaterial, but it will be better to carry it back as far as the slide D."

Trade Notes and Memoranda.

M. YVES GUYOT, Minister of Public Works, has prepared a scheme for a Paris underground railway, which he intends to present to the Chamber early in January. This scheme differs widely from that prepared by M. Bailhaut, and rejected by Parliament. It is far less gigantic than the scheme presented by his predecessor, and does not comprise any State subvention. A syndicate of credit establishments have, he affirms, presented themselves offering to carry out the scheme without any support from Government. The proposed line would start from the Place de la Madeleine, and, passing under the main boulevards, would reach the Place de la Bastille and the Vincennes Station. Thence it would be carried as far as the terminus of the Paris, Lyons, and Mediterranean Railway. Then, crossing the Seine, a little above the Isle St. Louis, follow the Rue de Rivoli, and thus reach the Place de la Concorde and its starting point, the Place de la Madeleine.

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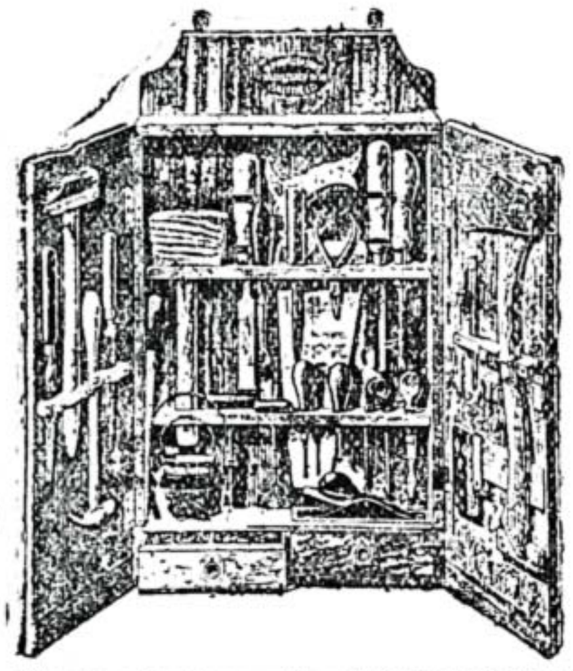

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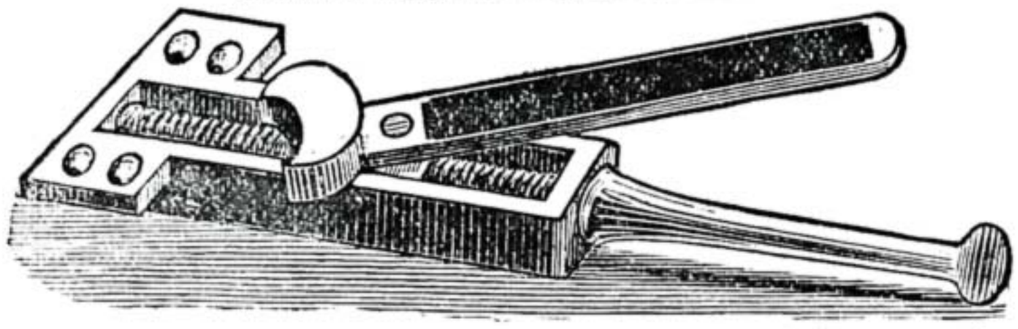

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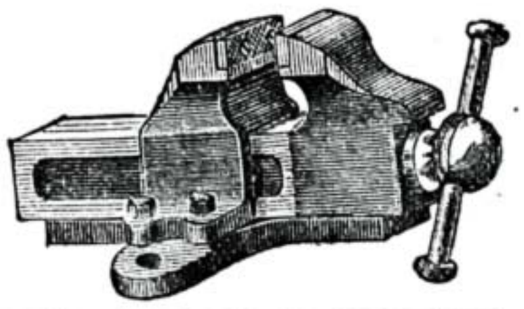

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